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# USSR Report

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

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10 December 1985

USSR REPORT  
LIFE SCIENCES  
BIOMEDICAL AND BEHAVIORAL SCIENCES

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## AGROTECHNOLOGY

### QUARANTINE SERVICE AND AGRICULTURAL RECONNAISSANCE

Minsk SELSKAYA GAZETA in Russian 7 Jul 85 p 3

KHACHIRASHVILI, V. (BELTA)

[Abstract] The functions of the State Plant Quarantine Service in Grodno are described. These include identification of seeds which tourists attempt to bring into the USSR illegally, to prevent introduction of foreign weeds such as the wormwoodlike Ambrosia. Potato nematodes were found in strawberry seedlings concealed in the trash bins of a train crossing the border. Fresh fruit and vegetables carrying San Jose scale, African cowpeas infested with four-spotted weevils and tomatoes bearing larvae of the potato moth have been detected. In all, 360 attempts to bring in quarantined plants were discovered in the first six months of 1985, the great majority due to passenger ignorance. Improvements in the Quarantine Service are planned, including a new facility at the Grodno railway station and new instrumentation such as fumigation chambers and X-ray equipment.

[383-12126]



## BIOCHEMISTRY

### ADVANCES IN NERVE CELL RESEARCH

Moscow PRAVDA in Russian 16 Aug 85 p 6

[Article by Academician Ye. Chazov: "Target--The Nerve Cell: The Competition for the USSR State Prize"]

[Text] One of the most important properties of living matter is the ability of cells to shift from a resting state to an active state--the phenomenon called excitability. In recent decades it has been established that this phenomenon is dependent on the existence of molecular structures in the cell membrane called "ion channels"--proteinaceous structures that can open and close in response to the effect of certain physical or chemical stimuli. When the channels are open they resemble tiny pores through which various ions can move both into the cell and out of it.

A square micrometer of membrane can contain from several to tens of thousands of ion channels. Some open in response to an electrical stimulus (electro-excitabile channels), and others (chemo-excitabile channels) open in response to certain chemical substances, called mediators. Tens of millions of ions can pass through each channel in a single second.

In the final analysis, the operation of the most important systems of living organisms depends on the remarkably fine coordination of the action of ion channels, which selectively and strictly control the passage of sodium, potassium, calcium and other ions. A classic example of the functioning of ion channels can be seen in the nerve impulse that arises in the nerve cell and is transmitted along its branches to other cells.

Electroencephalograms, electrocardiograms, and electromyograms, which are used extensively in modern clinical practice, are nothing more than cumulative recordings of electrical signals arising in large populations of brain, heart, and skeletal muscle cells as a result of the movement of ions through electro- and chemo-excitabile channels.

Ion channels also participate in a number of other processes, such as the initiation of contractions in cardiac and smooth muscle, glandular secretions of enzymes and hormones, cell growth and division, and the regulation of cell metabolism. Finally, it should be noted that many drugs and hormones act by means of a direct or mediated effect on ion channels.



Researchers in various fields are now focusing attention on the study of the properties and molecular organization of ion channels. They are trying to determine the structure of the protein molecules that form the ion channels and understand how these molecules affect the living organism.

It is gratifying to note that Soviet scientists have made an important contribution to the gains made in recent years in the study of these problems.

Over 10 years ago, at the initiative of Academician Yu. Ovchinnikov, in our country comprehensive research was started on ion channels and the membrane proteins of which they are made. This was the focus of two all-Union scientific programs that were established and carried out: "The Nerve Impulse" (1979) and "The Ion Channel," which united the efforts of electrophysiologists, chemists, physicists, biologists, and scientists in other fields. The methodological approach chosen by those participating in the project was unusual in that natural neurotoxins were used as one of the main "research instruments"--these are substances that some animal and plant organisms "learned" to synthesize in the process of fighting for their survival. Toxins from many cells and molecules of living organisms attack with amazing precision only those targets for which they were created by nature, and in the majority of cases these targets are ion channels. For example, components in the poison secreted by scorpions act only on electro-excitable ion channels in nerve fibers, and cobra venom contains substances that block the action of a key mediator--acetylcholine.

Several goals were set: to study in detail the mechanism of action of different neurotoxins on the properties of ion channels and their receptors and to use these toxins as a sort of "fishing rod" that would make it possible to "catch" the membrane proteins that form the channels, in order to study their chemical structure in more detail.

However, in order to begin this research, it was first necessary to perform the large and time-consuming job of isolating neurotoxins from the poisons of various animals. With this aim chemists and biologists studied more than 60 types of spiders, scorpions, snakes, and other animals from Central Asia and the Caucasus. Using specially developed methods, the scientists isolated in pure form 35 individual, previously unknown proteinaceous toxins. In spite of the exceptional complexity of the toxins' chemical structure, the scientists managed to decipher it, develop methods for the complete synthesis of several toxins, and study their spatial structure. The next step was to introduce special markers into the toxin molecules that would help identify the ion channels. Altogether more than 70 different derived toxins were created, containing various radioactive, fluorescent, and light-activated markers. This entire arsenal of "research instruments" was used to study the properties of ion channels and their receptors.

The many years of work provided new data on the structure and properties of several chemo-excitable ion channels found in the nerve cell membrane. Most of the attention, however, was focused on the study of electro-excitable sodium channels that play a key role in the generation and conduction of excitation impulses in nerve cells, nerve fibers, and cardiac and skeletal muscle fibers.

The research on sodium channels was conducted in two basic, complementary directions--electrophysiological and biochemical studies. Some data of fundamental importance were obtained on the role of different structural elements of the channel as it carries out its basic functions. It was established, for example, that by influencing certain segments of the sodium channel, it is possible to obtain a selective reduction or increase in its sensitivity to electrical signals. Also discovered was a "common regulatory center" in the channel which governs all its functions. Special attention was given to the interaction between several neurotoxins and certain drugs, including local anesthetics, and anti-arrhythmic and anti-convulsive drugs. New ways were discovered for controlled synthesis of a new class of chemicals--substances that modulate the action of drugs.

Important data on the properties and structure of sodium channels were obtained in the course of biochemical research. With the help of radioactive analogues of neurotoxins, it was determined that the richest source of sodium channels is the brain of warm-blooded animals, even though there are extremely few there (about 1 milligram in the brain of a cow). Nonetheless, with the help of neurotoxins, the scientists were not only able to isolate them in a pure form, but also to separate them into individual elements. The use of modern methods in physical and chemical biology made it possible to determine certain details about the spatial organization of sodium channels and to decipher successfully the chemical structure of these molecules. It was discovered that the sodium channel is a high-molecular protein-carbohydrate complex that penetrates the fatty (lipid) thickness of the membrane. Research on the details of its structure is proceeding at full speed.

On the whole, the results obtained made it possible to move even closer to an understanding of the molecular basis for neural excitation and to outline the most promising directions for further research. Specific approaches were identified for the development of methods for controlled action on ion channels, and consequently, for controlling the function of nerve cells. All this will serve as a basis for creating fundamentally new drugs to treat nervous system disorders.

The work that was done combined several different fields and was carried out at a number of different scientific centers in the Soviet Union: the Bioorganic Chemistry Institute imeni M. Shemyakin of the USSR Academy of Sciences, the Biochemistry Institute of the Uzbek SSR Academy of Sciences, the Physiology Institute imeni A. Bogomolets of the Ukrainian SSR Academy of Sciences, the Cytology Institute of the USSR Academy of Sciences, and the Surgery Institute imeni A. V. Vishnevskiy of the USSR Academy of Medical Sciences. The fundamentally new data obtained on the molecular mechanism involved in the generation of a nerve impulse and the creation of a new arsenal of instruments for studying this mechanism represent a major achievement by Soviet scientists, which has been nominated for the USSR State Prize.

UDC 547.963.32.057:577.113.4

SOLID-PHASE SYNTHESIS OF OLIGODEOXYRIBONUCLEOTIDES SUITABLE FOR DIRECT USE  
IN LIGASE REACTION

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 6, Jun 85  
(manuscript received 2 Nov 84; after revision 14 Dec 84) pp 808-814

GORN, V. V. and ZARYTOVA, V. F., Novosibirsk Institute of Bioorganic  
Chemistry, Siberian Department, USSR Academy of Sciences

[Abstract] Large DNA fragments with assigned sequence are obtained by a chemical-enzyme method, the solid-phase version being most promising. However, oligonucleotides thus produced do not have terminal phosphate groups as required for the ligase reaction. The authors suggest a number of improvements to a previously suggested scheme for solid-phase synthesis of oligodeoxyribonucleotides containing the 5'-terminal phosphate group. The improvements concern attachment of the first nucleotide link to the polymer, conditions of condensation and removal of the beta-cyanoethyl group. Twenty-seven oligonucleotides were synthesized by the method suggested and found to be suitable for direct utilization in the ligase reaction, based on the use of 5'-phosphorylated protected dinucleotides and bis-cyanoethyl-5'-mononucleotide esters. Figures 2; references 13: 6 Russian, 7 Western.  
[2038-6508]

UDC 547.963.32.057:577.113.4

SOLID-PHASE TRIESTER SYNTHESIS OF 5'-PHOSPHORYLATED OLIGODEOXYNUCLEOTIDES FROM  
BETA-CYANOETHYL p-CHLOROPHENYL N-ACYLNUCLEOTIDE-5'-PHOSPHATE ESTERS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 6, Jun 85  
(manuscript received 2 Nov 84; after revision 14 Dec 84) pp 815-820

BAUSK, Ye. V., GORN, V. V. and LEBEDEV, A. V., Novosibirsk Institute of  
Bioorganic Chemistry, Siberian Department, USSR Academy of Sciences

[Abstract] A method was recently suggested for solid phase triester synthesis of oligodeoxynucleotides by condensation of the 5'-phosphate group of the P-component attached to a polymer carrier with the 3'-oxy group of the OH component in solution. This method requires the use of nonstandard (CNet)<sub>2</sub>pN blocks in the final stage of synthesis. The present work describes conditions

of rapid deblocking allowing selective removal first of the 5'-p-chlorophenyl, then the 5'-beta-cyanoethyl protective groups, thus allowing synthesis of oligodeoxynucleotides with the 5'-phosphate group exclusively on the basis of standard (CNE<sub>4</sub>)(ClPh)pN blocks. The method is based on exposure of protected oligodeoxyribonucleotides to 0.33 M tetra-n-butylammonium fluoride followed by concentrated ammonium hydroxide. Figures 5; references 7: 6 Russian, 1 Western.  
[2038-6508]

UDC 547.458.057

CONVENIENT SYNTHON FOR PREPARATION OF Le and ABH (TYPE 1) DETERMINANT OLIGOSACCHARIDES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 6, Jun 85  
(manuscript received 23 Oct 84; after revision 24 Jan 85) pp 826-829

BOVIN, N. V. and KHORLIN, A. Ya., Institute of Bioorganic Chemistry imeni M. M. Shemyakin, USSR Academy of Sciences, Moscow

[Abstract] Selective glycosylation of diol is described, leading to a disaccharide which is a promising synthon in oligosaccharide synthesis. Reaction of the diol with acetobromogalactose was performed in a benzene-nitromethane mixture (1:1) at 60°C until the diol disappeared completely. The disaccharide was separated, by crystallization, with a yield of 55%. The compound produced is a direct precursor of the trisaccharide Le<sup>a</sup>.  
References 8: 3 Russian, 5 Western.  
[2038-6508]

UDC 547.422(22+23)'118.057

SYNTHESIS AND STUDY OF GLYCOLDISPHOSPHATES, REVERSIBLE HEMOGLOBIN OXYGENATION REGULATORS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 6, Jun 85  
(manuscript received 29 Nov 84) pp 845-848

CHUVILIN, A. N., SEREBRENNIKOVA, G. A., YEVSTIGNEYEVA, R. P., Institute of Precision Chemical Technology imeni M. V. Lomonosov, Moscow; KOL'TSOVA, G. N., VYAZOVA, Ye. P. and ROZENBERG, G. Ya., Central Scientific Research Institute of Hematology and Blood Transfusion, Moscow

[Abstract] One promising trend in the search for artificial oxygen carriers is their creation on the basis of natural hemoglobin. Solutions of non-erythrocyte hemoglobin have significantly higher affinity for oxygen than whole blood, hindering oxygen transfer in the tissues. A reversible oxygenation regulator must be included in artificial oxygen transfer media based on hemoglobin. The creation of effective, simpler functional analogues of DPG for use in vivo is promising. The authors synthesized and tested ethylene-glycolbiphosphate and 1,2-propanediolbiphosphate as hemoglobin oxygenation



regulators. The biphosphates significantly increase  $p_{50}^{O_2}$  and thus decrease the affinity of hemoglobin for oxygen, though to a lesser extent than does DPG. The substances have certain advantages, however, in the easy availability of the raw materials and higher yield of synthesis. References 14: 2 Russian, 12 Western.  
[2038-6508]

UDC 577.152.314'14

DETERMINATION OF SUBSTRATE SPECIFICITY OF Eco471 AND Eco521 RESTRICTION  
ENDONUCLEASES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 31 Jan 85) pp 987-988

BUTKUS, V. V., PYATRUSHITE, M. P., YANULAYTIS, A. A., Scientific-Production  
Association 'Ferment,' Vilnius

[Abstract] Direct methods are used to confirm the substrate specificity and determine the locus of splitting of sites of Eco471 and Eco521 restrictases. The structure of the two restrictase sites was confirmed, the locations of their splitting established by analysis of 5'-terminal sequences of splitting segments. The combination of the results obtained led to the conclusion that the DNA of restrictase Eco471 includes 5-member duplexes, that of restrictase Eco521--6-member duplexes, splitting them at definite locations. Eco471 and Eco521 are thus true isoschizomers of the known restrictases Ava II and Xma III. Figures 2, references 5: 1 Russian, 4 Western.  
[2039-6508]

UDC 578.816.1'204

INACTIVATION OF INFECTIVITY OF PHAGE MS2 UNDER INFLUENCE OF ETHYLENEIMINES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 28 Feb 85) pp 989-991

BUDOVSKIY, E. I., ZALESSKAYA, M. A., Institute of Bioorganic Chemistry imeni M. M. Shemyakin, USSR Academy of Sciences, Moscow; LESHCHINSKAYA, V. P., and KOSTYANOVSKIY, R. G., Institute of Chemical Physics, USSR Academy of Sciences, Moscow

[Abstract] When any inactivating agent acts on viruses, both modification of the nucleic acid, causing inactivation of infectivity, and modification of other virion components, causing changes in effectiveness and specificity of the immune response, occur. Therefore, production of killed antiviral vaccines requires agents which primarily modify polynucleotides. The rate of modification of each component of the virion depends on the reactivity and concentration of the reagent. Selective increases in the rate of modification of one component of the virion are possible if the reagent has specific

affinity for it and, consequently, there is an increase in local concentration of the reagent near the component. In this work, to determine the influence of the positive charge on local concentration near a polynucleotide, a study was made of the kinetics of modification of RNA under the influence of ethyleneimine and its oligomers with the general formula  $(CH_2)_2N-(CH_2-CH_2-NH)_nH$  where  $n = 0, 1, 2$  and  $3$ . The criterion of nucleic acid modification rate was the rate of inactivation of infectivity of the bacteriophage MS2, an RNA-containing virus. The rate of inactivation of infectivity was found to increase sharply with an increase in total positive charge of reagent which probably results from an increase in local concentration of the reagent near the viral RNA. Decreasing pH also increases the rate of inactivation by increasing the total charge and/or increasing the concentration of the active form of the reagent. There is a critical value of pH, below which the consumption of the reagent in side reactions has a significant influence on inactivation kinetics. Figure 1; references: 7 Western. [2039-6508]

UDC 577.113.6:542.95

# AUTOMATIC SYNTHESIS OF OLIGODEOXYRIBONUCLEOTIDES. I. STUDY OF 'SILOCHROM' BRAND SILICA GEL-BASED CARRIERS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 23 Oct 84; after revision 22 Mar 85) pp 920-926

LOMAKIN, A. I., YASTREBOV, S. I. and POPOV, S. G., All-Union Scientific Research Institute of Molecular Biology, Kol'tsovo, Novosibirsk Oblast

[Abstract] Mechanically stable, easily washed, nonswelling inorganic carriers based on silica gel are the most suitable for automatic solid phase synthesis of oligonucleotides. This article reports on production of a number of carriers based on Silochrom brand silica gel and compares them with carriers based on porous glass with controlled pore dimensions type CPG. It was found that carriers based on Silochrom C-120 and CPG had similar yields, while carriers based on C-80 produced even higher yields in test experiments. C-40 produced a carrier with unexpectedly low yield in the first stage of condensation. The results thus indicate that carriers based on Silochrom C-80 and C-120 meet the requirement placed on polymer carriers being equal to known carriers based on porous glass with controlled pore size, and may be quite useful for automatic solid phase synthesis of oligonucleotides. Figures 3; references 16: 4 Russian, 12 Western. [2039-6508]



## AUTOMATIC SYNTHESIS OF OLIGODEOXYRIBONUCLEOTIDES. II. USE OF SEGMENTED, CELLULOSE-BASED CARRIERS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 23 Oct 84; after revision 22 Mar 85) pp 927-933

LOMAKIN, A. I. and POPOV, S. G., All-Union Scientific Research Institute of Molecular Biology, Koltsovo, Novosibirsk Oblast

[Abstract] The use of segmented cellulose carriers (paper disks) allows production of large numbers of oligonucleotides simultaneously. This work studies the possibility of using segmented carriers of this type in automatic oligodeoxyribonucleotide synthesis in a 'Viktoriya-2' column-type automatic reactor. Load levels of up to 300 micromoles per gram were achieved in the synthesis of five oligodeoxyribonucleotides 13 to 18 units in length. Simultaneous performance of several condensations using mono- and dinucleotide blocks allowed significant reduction in total number of stages and time of synthesis. The results obtained indicated that the installation with modified hydraulic system is quite promising for simultaneous synthesis of large numbers of oligonucleotides under automatic control. Figures 2; references 13: 4 Russian, 9 Western.  
[2039-6508]

UDC 577.155.2

## ISOLATION AND PROPERTIES OF ACID SITE-SPECIFIC ENDONUCLEASE FROM MATURE EGGS OF SEA URCHIN STRONGYLOCENTROTUS INTERMEDIUS

Moscow BIOKHIMIYA in Russian Vol 50, No 7, Jul 85  
(manuscript received 3 Sep 84) pp 1095-1104

SIBIRTSEV, Yu. T., KONECHNYI, A. A. and RASSKAZOV, V. A., Pacific Ocean Institute of Bioorganic Chemistry, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok

[Abstract] Site specific endonucleases formed in the cells of some animals are of particular interest. Enzymes of this type hydrolyze DNA at a limited number of sites near or within palindromic sequences forming specific fragments. This article describes a method of isolating acid endonuclease from unfertilized mature sea urchin egg cells and presents results of study of certain properties of the enzyme. Site-specific acid DNAase, pH 5.5, was found in both mature egg cells and in embryonal cells. The enzyme preferentially splits DNA at certain specific sites. Specificity is more clearly expressed in earlier stages of hydrolysis. The enzyme is capable of showing maximum activity at relatively high NaCl concentrations, though activity decreases at over 150 mM NaCl. Figures 8; references 17: 3 Russian, 14 Western.  
[2068-6508]

## INFLUENCE OF HYPERTHERMIA ON POLYPEPTIDE COMPOSITION OF NUCLEAR RAT LIVER MATRIX

Moscow BIOKHIMIYA in Russian Vol 50, No 7, Jul 85  
(manuscript received 14 Nov 84) pp 1127-1131

AKOPOV, S. B., BUL'DYAYEVA, T. V., KUZ'MINA, S. N. and ZBARSKIY, I. B.,  
Institute of Biology of Development imeni N. K. Kol'tsov, USSR Academy of  
Sciences, Moscow

[Abstract] A study is made of the polypeptide profile of rat liver cell fractions subjected to a temperature of 45°C for 90 or 120 minutes. The animals were heated in a special chamber at a constant temperature of 45°, relative humidity 20%, for 90 and 120 minutes, causing rectal temperature to rise by 2-3°C. The animals received <sup>14</sup>C chlorella protein hydrolysate at 1 microCurie per gram of body weight. The animals were sacrificed by decapitation, cell nuclei and matrix preparations obtained, protein composition studied by electrophoresis in polyacrylamide gel containing DS-Na. It was found that increasing body temperature by 2-3°C causes the same phenomena in the liver nuclear matrix as are observed upon thermal shock of the cells in culture. The mechanism of inhibition of protein synthesis may be the same as in thermal shock in culture. Figures 2; references 18: 4 Russian, 14 Western.  
[2068-6508]

UDC 577.152.311

## STRUCTURAL SPECIFICS OF CHOLINERGIC LIGAND RECOGNITION SITES OF NICOTINIC ACETYLCHOLINE RECEPTOR FROM SQUID OPTICAL GANGLIA

Moscow BIOKHIMIYA in Russian Vol 50, No 7, Jul 85  
(manuscript received 3 Dec 84) pp 1167-1174

PLYASHKEVICH, Yu. G. and DEMUSHKIN, V. P., Scientific Research Institute of  
the Brain, All-Union Scientific Center of Mental Health, USSR Academy of  
Medical Sciences, Moscow

[Abstract] A method of chemical modification is used to determine the specifics of the structure of the nicotinic acetylcholine receptor of squid optical ganglia. <sup>3</sup>H methyl iodide and <sup>14</sup>Cd-tubocurarine were used as labels. The membrane preparation was isolated from the optical ganglia of *B. magister*. The membrane preparation was suspended by a Potter homogenizer in buffer A and exposed to the modifying reagent with or without nicotine or tetramethyl ammonium in the buffer. The membrane preparations were then centrifuged at 20,000 g. The method of chemical modification determined the functional groups and amino acid residues of the receptor participating in bonding of cholinergic ligands. The influence of chemical modification of methionine- histidine, cystine, tyrosine and arginine and amine and carboxyl groups on bonding of both agonists and antagonists was determined. Two subpopulations of bonding

sites were found, differing in the composition of amino acids they contained. The data indicate that arginine, tyrosine and carboxyl groups participate in the first subpopulation, with arginine replaced by an amino group in the second subpopulation. Figures 3; references 23: 6 Russian, 17 Western. [2068-6508]

UDC 615.2+612.015.32:616.45-001.113

#### DYNAMICS OF PEROXIDE OXIDATION OF LIPIDS DURING STRESS

Yerevan BIOLOGICHESKIY ZHURNAL ARMENII in Russian Vol 38, No 5, May 85  
(manuscript received 12 Aug 84) pp 393-398

MIKAYELAN, E. M., MKHITARYAN, V. G., Department of Biochemistry,  
Yerevan Medical Institute

[Abstract] The dynamics of peroxide oxidation of lipids (POL) was studied on white rats during acute stress of varying duration and during chronic stress. The results showed alterations in formation and removal of lipo-peroxides, the direction and intensity depending on the stage of stress and on tissue specificity. During acute stress, POL intensified, especially in the heart. In this study, it was shown that  $\alpha$ -tocopherol levels in blood and in erythrocyte membranes dropped during acute stress, while they remained stable in the heart, liver and brain, occasionally even increasing. Repeated stress intensified the POL and activated the glutathioneperoxidase-glutathionereductase system. Under chronic stress, the POL diminished,  $\alpha$ -tocopherol levels in tissues became lower in all phases of the stress, altering the structure and function of biomembranes and necessitating antioxidative prophylactic measures as well as therapeutic interventions because the cell metabolism was compromised. Figures 5; references 13: 8 Russian, 5 Western. [2055-7813]

## BIONICS

### LINE RESOLUTION BY VISUAL CENTER OF BRAIN

Moscow MOSKOVSKAYA PRAVDA in Russian 9 Aug 85 p 3

MOZHAYEVA, Ye.

[Abstract] In order to construct robots with visual capabilities, precise knowledge about the mechanisms of human vision is needed. Recently, work in this area has involved detector theory. The visual center of the brain contains separate neurons for horizontal, vertical and diagonal lines, a series of which neurons fire to form an image. This aspect of vision is being studied by a group at the Institute of Higher Nervous Activity and Neurophysiology of the USSR Academy of Sciences. Using implanted electrodes, the group found that horizontal and vertical lines are similar in semi-darkness. Under difficult visual circumstances, the mechanisms for distinguishing detail are suppressed, and those for forming contours enhanced. About two-thirds of the visual neurons can reorganize themselves in this manner, in response to poor contrast as well as low light.

[378-12126]

STUDY OF METHOD OF AERATION OF RIBOXIN-PRODUCING CULTURE WITH INTENSIVE FOAM FORMATION DURING BIOSYNTHESIS

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 5, May 85  
(manuscript received 28 Dec 82) pp 588-592

CHAGIN, B. A., BELYANINA, V. F., BOGATKOV, L. G., ROMANENKO, G. I.,  
KUZMENOK, V. A. and KOCHENOVA, M. M., Penza Branch, All-Union Scientific  
Research Institute of Antibiotics

[Abstract] The patent literature contains many reports of mechanical foam dampers which break down foam by the impact of solid surfaces. However, these devices have practically never been used in sterile production facilities due to the complexity of their use. Aerodynamic foam damping seems most suitable for sterile processes. This work studies the influence of various technological parameters on the process of biosynthesis of riboxin with aerodynamic foam damping. Studies were performed under pilot-scale conditions in a three cubic meter apparatus using a commercial strain of *Bac. subtilis*, the initial medium containing 10 to 15% glucose, 1 to 2% ammonium nitrate, 2% protein-vitamin concentrate and 0.3% magnesium sulfate. Experimental biosynthesis in the three cubic meter apparatus showed the advantages of aerodynamic foam damping over the use of chemical foam damping, including an increase in the content of riboxin in the culture fluid and an increase in its volume when drained.

Figures 4; references 5: 4 Russian, 1 Western.

[2069-6508]

MICROBIOLOGICAL PROTEIN AND BIOFUEL

Yerevan KOMMUNIST in Russian 31 Jul 85 p 4

AFRIKYAN, E., director, Institute of Microbiology, academician,  
Armenian SSR Academy of Sciences

[Abstract] Various aspects of modern biotechnology are discussed, including use of microorganisms as a source of protein and development of yeast which utilize petroleum byproducts as part of their growth media, as well as methods for purifying waste and increasing plant protein content by microbiological means. Microorganisms are also used to process various fuels, particularly to produce methanol, ethanol and hydrogen. If the 230 million tons of animal

waste produced in the USSR annually were processed microbiologically, 200 million cubic meters of gas and at least 20 million tons of organic fertilizer could be obtained. Algae which can be cultivated on saline soil effluent are being studied in Armenia. Widespread introduction of methane waste fermentation could be a radical method for combating eutrophication of Lake Sevan. Devotion of further resources to biotechnology should result in substantial progress in both food and fuel areas.  
[1984-12126]



UDC 579.841.93.083.3:577.114.5

SOMATIC ANTIGENS OF BRUCELLA GENUS. STRUCTURE OF O-SPECIFIC POLYSACCHARIDE  
CHAIN OF BRUCELLA MELITENSIS LIPOPOLYSACCHARIDE

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 27 Dec 84) pp 963-969

LVOV, V. L., MALIKOV, V. Ye., DRANOVSKAYA, Ye. A. and DMITRIYEV, B. A.,  
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of Medical Sciences, Moscow; and SHASHKOV, A. S., Institute of Organic Chemistry  
imeni N. D. Zelinskiy, USSR Academy of Sciences, Moscow

[Abstract] Bacteria of the brucella genus are nonencapsulated, nonmobile, non-sporeforming, gram-negative coccobacilli, facultative intracellular parasites. The purpose of this work, the beginning of a systematic study of somatic antigens of bacteria of the brucella genus, is determination of the chemical structure of the O-specific lipopolysaccharide chain from a virulent strain of *B. melitensis* 565 and the vaccine strain *B. abortus* 19-BA, since a study of immunogenesis in brucellosis, determination of pathogenic factors and serologic affinity of brucella with other pathogens requires knowledge of the chemical structure of antigens on the outer membrane of the bacteria. The LPS was isolated by extraction of dry killed bacterial cells in hot aqueous 45% phenol with subsequent separation of the phenol layer by centrifugation and dialysis. Serologic activity of the LPS was studied using gel immunodiffusion and ring precipitation reactions. The antigen was separated by column chromatography. Mild acid degradation of the lipopolysaccharide results in formation of the O-specific homopolysaccharide, the structure of which was determined primarily by NMR spectroscopy and methylation analysis. The polysaccharide from the vaccine strain was shown to be completely identical to the polysaccharide from the virulent strain. Figures 2; references 18: 8 Russian, 10 Western.  
[2039-6508]

POPULATION DISTRIBUTION PATTERNS OF THREE GERBIL SPECIES

Moscow ZHURNAL OBSHCHEY BIOLOGII in Russian Vol 46, No 4, Jul-Aug 85  
(manuscript received 28 Apr 83) pp 565-568

TKACHENKO, V. S., Caucasus and Transcaucasus Plague Control Scientific  
Research Institute, Stavropol

[Abstract] An analysis was conducted on the population distribution patterns of three gerbil species in Azerbaijan over the period 1974-1979, in order to determine criteria suitable for statistical analysis of endemic populations. The distribution patterns of *Meriones tristrami* and *M. persicus* were in agreement and could be described by Poisson distribution, whereas that of *M. erythraeus* required an exponential equation with a high degree of asymmetry. These observations indicate that a comparative analysis of different areas for gerbil population densities requires the use of nonparametric criteria, since the distribution patterns differ from normal and are highly asymmetrical. Figures 1; references: 5 Russian.  
[2052-12172]

INTMID pInt $\lambda$ 1-MEDIATED INCREASE IN UV-RESISTANCE AND UV-INDUCED MUTAGENESIS  
IN E. COLI: INTEGRATIVE-REPLICATIVE MECHANISM OF ACTION

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 283, No 4, Aug 85  
(manuscript received 4 Feb 85) pp 1003-1007

ALESHKIN, G. I. and SKAVRONSKAYA, A. G., Institute of Epidemiology and  
Microbiology imeni N. F. Gamaleya, USSR Academy of Medical Sciences, Moscow

[Abstract] Studies were conducted on the mechanism by which intmid pInt $\lambda$ 1 (vector plasmid with gene intC57 of phage  $\lambda$ ) enhances UV-resistance and spontaneous and UV-induced mutagenesis in E. coli. Analysis of the UV-inactivation and mutagenesis data demonstrated that the effects of the intmid were due to its integration into the bacterial chromosome and participation in replicative processes. Both mutations himA, which affects the ability of pInt $\lambda$ 1 to integrate with the chromosome, and mutation polA1, which interferes with replication, abolish these effects of pInt $\lambda$ 1. The formation of a single integrated structure between the chromosome and pInt $\lambda$ 1, and its dependence on the intmid pInt $\lambda$ 1 replication complex, represents a universal integrative-replicative mechanism since it has been demonstrated to figure in the case of other plasmids. Figures 4; references 15: 4 Russian, 11 Western.  
[2050-12172]

DISTRIBUTION OF DELAYS IN HUMAN ALTERNATIVE REACTIONS

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 6, Jun 85  
(manuscript received 30 Jan 85) pp 125-128

KHERMANIS, E. Kh., ENINYA, G. I., ROBULE, V. Kh., VASARIN'SH, G. E. and  
MEZHAK, A. Ya., Institute of Electronics and Computer Technology, LatvSSR  
Academy of Sciences; Riga Medical Institute

[Abstract] In an attempt to develop diagnostic criteria, alternative reactions in human subjects were studied as a function of the intensity of the input stimulus and its effect on the ocular system using an original visual stimulation analyzer with lights of different intensity. A mathematical model was developed for the distribution of delays of alternative reactions (one of the reactions was obviously wrong). The narrower this distribution, the better was the fit of such a model. These delays may be periodic and random. The cycling is characteristic of individual subjects. Figures 4; references 6: 4 Russian, 2 Western.  
[2062-7813]

UDC 612.112.94.017.1-063

MONOSPECIFIC ANTIBODIES TO ARTIFICIAL T-ANTIGEN, CHARACTERISTICS OF THEIR SPECIFICITY AND USE FOR IDENTIFICATION OF CELL SURFACE T-ANTIGENIC DETERMINANTS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 13 Dec 84) pp 908-919

MEDVEDEV, A. E., GABRIELIAN, N. D., BOVIN, N. V. and KHORLIN, A. Ya.,  
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Sciences, Moscow

[Abstract] The purpose of this work was to produce monospecific antibodies to synthetic T-antigen, describe their specificity and use them to identify T-antigenic cell surface determinants. T-antigens were synthesized. A conjugate with cytochrome c contained 14% carbohydrate, and this neoglycoprotein was used to study the specificity of the anti-T antibody. The antibodies isolated were found to be carbohydrate specific. In spite of the significant influence of the aglycon spacer on bonding of inhibitor with active centers of antibodies, the disaccharide group was found to be necessary in all cases for inhibitor activity. Interactions of desyalted human erythrocytes with the monospecific anti-T antibodies produced were studied by hemagglutination, indicating that the monospecific antibodies agglutinated desyalted erythrocytes but did not react with native erythrocytes. The next stage of the work was detection of T-antigen on the surface of mouse cortical thymocytes. Monospecific antibodies with synthetic T-antigen were thus obtained. The antibodies react specifically with natural T-antigen and can be used to study processes of differentiation and tumor transformation accompanied by appearance of carbohydrate cell surface antigens. Figures 5; references 28: 3 Russian, 25 Western.  
[2039-6508]

UDC 616-097:611-018.54

HBsAg ASSOCIATED POLYALBUMINBINDING ABILITY OF BLOOD SERUM

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 6, Jun 85  
(manuscript received 15 Feb 85) pp 54-59

BLYUGER, A. F., YELIGULASHVILI, R. K. and SERGEYEVA, S. M., Riga Medical  
Institute

[Abstract] In the early 70's, reports appeared indicating that blood sera from patients with liver disease cause agglutination of erythrocytes covered

with polymerized human serum albumin (PHSA). Further studies showed that PHSA-binding ability of blood serum may be due to the reaction of PHSA with surface antigen of hepatitis B virus (HBsAg). The biological role of PHSA-receptor for HBsAg may be very crucial in pathogenesis of viral hepatitis B (VHB). The goal of this study was to investigate the possibility of using solid phase immunoenzymic analysis (IEA) in determining HBsAg associated PHSA-binding ability during HBV infections. In the first series of experiments it was shown that HBsAg binding was observed only in the cells covered with PHSA but not in those sensitized with bovine serum albumin and native human serum albumin. In the second series, it was shown that a pretreatment of the serum with PHSA solution (500 µg/ml) blocked the ability of HBsAg to be adsorbed in the cells covered with PHSA. It was concluded that determination of polyalbuminbinding ability of HBsAg could be a more sensitive marker for viral replication than HBeAg. Figures 2; references 23: 3 Russian, 20 Western.  
[2062-7813]



## MEDICINE

UDC 615.468.6.014.45

### COMMERCIAL METHOD OF RADIATION STERILIZATION OF CATGUT WITH ATRAUMATIC NEEDLES IN POLYMER PACKING

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 5, May 85  
(manuscript received 18 Jun 84) pp 618-620

GILMUMDINOV, I. G., BAYBEKOV, E. B. and BONDAREVA, L. N., All-Union Scientific Research Institute of Technology of Blood Substitutes and Hormone Preparations, Moscow

[Abstract] In 1982, the surgical suture materials plant of Kazan' 'Tatkhim-farmpreparaty' Production Chemical-Pharmaceutical Association introduced a new 'Pintset' installation, a stationary gamma installation with concrete and lead protective system. One great advantage of the system is that it allows the production of a new product, sterile catgut with ATRAUMATIC NEEDLES IN POLYMER PACKAGING. The radiation dose used to sterilize the catgut is 3 Mrad. Microbiological testing of the catgut-needle product showed that with this radiation dosage the product achieved the required guaranteed sterility, which was retained throughout its entire period of storage. The physical and mechanical properties of the product are not altered by radiation sterilization under these conditions. References 8 (Russian).  
[2069-6508]

### NEW APPROACH TO SURGERY OPPOSED

Moscow SOVETSKAYA KULTURA in Russian 10 Aug 85 p 8

YAROVINSKIY, M., Candidate of Medical Sciences

[Abstract] This is a commentary which points out the difficulties facing introduction of new medical technology in the face of bureaucracy. It is based on the case of Dr. Kanshin, the surgeon, who developed a number of procedures and new equipment while working in an outdated (175 years old) hospital and then faced all sorts of problems in introducing these innovations to general use. Specifically, this paper covers Dr. Kanshin's revolutionary approach to treatment of purulent infections often accompanying surgical procedures: instead of opening wounds for drainage, he sutured them. The controversy among physicians is illustrated by the statements made in a monograph "Wounds and Wound Infections" in which on one page his procedure is called "baseless"

and on the very next one it is recommended as an innovative technique. Kanshin (Prof. Nikolay N. Kanshin, Sheremetevo Hospital) hopes that innovative techniques will be introduced in all clinics, in all surgical suites at the earliest possible time.  
[2046-7813]

## LASER EFFECTS

UDC 615.814.1.03:617-089.5(048.8)

### LASER REFLEXOTHERAPY--NEW DEVELOPMENT IN CORRECTION OF BLOOD CIRCULATING INSUFFICIENCY IN BRAIN

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 6, Jun 85  
(manuscript received 26 Oct 84) pp 90-95

NIKOLAYEV, N. A. and MAYORE, I. Kh., Riga Medical Institute

[Abstract] A method was developed without using drugs for the correction of blood circulation insufficiency in the brain of patients with initial manifestation of insufficient blood circulation in brain syndrome (IMBCB); this new method was based on stimulation of specific acupuncture zones with low energy helium-neon laser. The method was described; vasoactive points were identified which permit control of the tonus of specific vascular regions in brain. The effect of laser reflexotherapy (LPT) of coagulating blood system was established, manifested as a slowdown of initial blood coagulation phases. This was probably due to a slower formation and activation rate of thrombin. This method could find wide application in prophylactic and therapeutic intervention in neurological clinics for patients with IMBCB. References 16: 11 Russian (1 by Western author), 5 Western.  
[2062-7813]

UDC 113.4:577.23

PRODUCTION OF GENE LIBRARIES BY PARTIAL FILLING OF DNA TACKY ENDS

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 6, Jun 85  
(manuscript received 31 Jan 85) pp 849-852

ZABAROVSKIY, Ye. P., Institute of Molecular Biology, USSR Academy of Sciences, Moscow; ALLIKMETS, R. L., Institute of Bioorganic Chemistry imeni M. M. Shamyakin, USSR Academy of Sciences, Moscow

[Abstract] Methods of gene library production are being constantly improved both by construction of new vectors and by development of new methods of eliminating nonrecombinant (wild) vectors, particularly phages. To overcome synthesis difficulties, a method described earlier by the authors for production of human gene libraries was modified. Vector DNA was cut with Sall and EcoRI restrictases, the reaction halted by heating to 65°C for ten minutes. The mixture was then incubated one hour at 42°C, after which dCTP and dTTP were added to a concentration of 50 micromoles, plus DNA-polymerase I of E. coli, followed by 30 minutes incubation at 20°C. The DNA was precipitated with an equal volume of isopropyl alcohol and the sediment dissolved in TE buffer. The method allows rapid production of a gene library (in two to three days) from microscopic quantities of DNA, since it does not include fractionation of genome DNA or separation of secondaries, the longest, most difficult and wasteful of the operations of the previous method. References 8: 2 Russian, 6 Western.  
[2038-6508]

UDC 577.212.3+579.873.1

NUCLEOTIDE SEQUENCE OF ACTINOMYCETE PLASMID pSB24.2 DNA

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 283, No 4, Aug 85  
(manuscript received 3 Apr 84) pp 1014-1017

BOLOTIN, A. P., SOROKIN, A. V., ALEKSANDROV, N. N., DANILENKO, V. N. and KOZLOV, Yu. I., All-Union Scientific Research Institute of Genetics and Breeding of Industrial Microorganisms, Moscow

[Abstract] Mapping studies were conducted on actinomycete plasmid pSB24.2, a stable deletion analog of plasmid pSB24.1, obtained by passing the latter in Streptomyces lividans. The pSB24.2 DNA is characterized by a G+C content of 73%, which corresponds to the G+C content of actinomycete DNA. Sites are

delineated on the map with a G+C content of less than 55%, nucleotide frames lacking terminator codons, sites of some inverted sequences, and restrictase target sites. Analysis for potential protein encoding regions led to the identification of a 600 triplet area analogous to protein-coding sequences in actinomycete DNA, followed by a transcription termination structure. Such information may be useful for future construction of recombinant DNA in actinomycete cells. Figures 3; references 12: 1 Russian, 11 Western.  
[2050-12172]

UDC 579.25

INTRODUCTION OF MU BACTERIOPHAGE INTO AZOTOBACTER CHROOCOCCUM AND INTERGENERIC GENE TRANSFER MEDIATED BY RP4::MU PLASMID

Kiev BIOPOLIMERY I KLETKA in Russian Vol 1, No 4, Jul-Aug 85  
(manuscript received 17 Aug 84) pp 219-224

RASCHINKINA, A. S., TROITSKIY, N. A. and OKULICH, L. A., Institute of Genetics and Cytology, BSSR Academy of Sciences, Minsk

[Abstract] Bacteriophage Mu introduced into resistant gram-negative bacteria contained in transmissible plasmids can be expressed in many new hosts. The goal of this study was to introduce Mu bacteriophage into Azotobacter chroococcum and to evaluate donor properties of the obtained strain in heterospecific crossing with E. coli. Recombinant plasmid RP4::Mucts62 was obtained by lysogenization of E. coli C600(RP4) strain with Mucts62 phage. The plasmids RP4::Mucts62 and RP4 were transferred to five strains of the azobacter at a frequency of  $10^{-4}$  to  $10^{-3}$ . In a number of azobacter strains Mucts62 phase DNA was replicated producing about  $10^5$  plaque-forming units per ml. The strain A. chroococcum 31/8 (RP4::Mucts62) was used as a donor of chromosomal genes in crossing with E. coli AB 1157 recipient. The RP4::Mucts62 plasmid-mediated transfer of thr and his markers was observed. Similar frequency in transfer of these markers may indicate equal probability of Mu inclusion in various segments of azobacter chromosomes and transposition of genes towards the introduced plasmid. References 15: 2 Russian, 13 Western.  
[2065-7813]

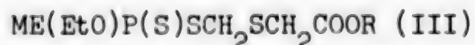
UDC 547.26'118:541.691:577.152.311.042

ROLE OF ESTERASE IN TOXIC PROPERTIES OF THIOORGANOPHOSPHORUS  
INSECTOACARICIDES CONTAINING MERCAPTOACETIC ACID FRAGMENT

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
(manuscript received 31 Jan 85) pp 957-962

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ODOYEVA, G. A., SHESTAKOVA, N. N., KHOVANSKIKH, A. Ye., Institute of Evolutionary Physiology and Biochemistry imeni I. M. Sechenov, USSR Academy of Sciences, Leningrad; MASTRYUKOVA, T. A., SHIPOV, A. E., ZHDANOVA, G. V. and KABACHNIK, M. I., Institute of Heteroorganic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow

[Abstract] The carbalkoxyl groups in organophosphorus insecticides allow them to be selectively toxic. Hydrolysis of an ester group located some distance from a phosphorus atom leads to detoxication of compounds. Detoxication results from the fact that the negatively charged carboxylate anion formed prevents sorption of the inhibitor on the active cholinesterase surface, which is also negatively charged. To test this assumption, methyldithiophosphonates of the general formula



were synthesized. To determine the biochemical basis of the selective action of compounds (III) on the example of O-ethyl-S-(carbomethoxymethylmercapto-methyl) methyldithiophosphonate (IIIa), a study was made of the interaction of this compound and possible products of its metabolic activation and detoxication with mammalian esterase samples. It was found that (IIIa) is subject to effective carboxylesterase hydrolysis, indicating that the significant difference in toxicities of (IIIa) dithiophosphonate and its monothioanalogue result apparently from rapid hydrolysis of (IIIa) under the influence of carboxylesterase. Hydrolytic detoxication is thus a significant, possibly the major, direction of metabolism of (IIIa) dithiophosphonate by mammals. References 16: 10 Russian, 6 Western.  
[2039-6508]



# ARE REGULATORY CATION-BONDED CENTERS OF THE OPIATE RECEPTORS A PART OF THE POTENTIAL-DEPENDENT NEUROMEMBRANE CALCIUM CHANNELS?

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 11, No 7, Jul 85  
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[Abstract] It has been suggested that the bonding center of  $\text{Ca}^{2+}$  ions on the membrane channel is the regulatory sector of the opiate receptor. This work tests this assumption by comparing the results of investigation of  $\text{K}^{+}$ -stimulated  $\text{Ca}^{2+}$  ion transport and the influence of metal ions on opiate reception. Isolated nerve endings--synaptosomes--obtained from rat brains were used as the object of the study. The capture of  $\text{Ca}^{2+}$  ions initiated by an increase in the concentration of  $\text{K}^{+}$  ions in the incubation medium was studied by a method described earlier. The data indicated that the  $\text{Ca}^{2+}$  bonding centers in the ion channel did not coincide with the regulatory cation-bonding sector of the opiate receptors. This was confirmed by data on the specific inhibitory effect of transition metal ions on  $\text{Ca}^{2+}$  transport. Figures 2; references 9: 4 Russian, 5 Western.  
[2039-6508]

UDC 615.33/.35.015.44:612.014.421

# MEMBRANE BIOELECTROCHEMICAL SENSORS FOR DETERMINATION OF BIOACTIVE COMPOUNDS (LITERATURE REVIEW)

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 7, Jul 85  
(manuscript received 21 Aug 84) pp 775-778

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[Abstract] A minireview is provided of the use of enzyme and membrane electrodes for the detection and quantification of bioactive substances, using either potentiometric or amperometric measurements. The essential approach is that the analyte-induced change, either in the membrane components or in enzymatic activity, induces electrical changes that are subject to amplification and quantification. For example, a membrane sensor--consisting of lipid-impregnated Millipore ultrafilters over a pH electrode--made possible analysis of a number of organic cations in aqueous solutions, giving a sensitivity of  $10^{-6}$  M with the antiviral remantadine. The sensitivity of such sensors can often be improved 1000-fold by relying on chemical or immunochemical amplification as a result of enzyme action. The use of such bioelectrochemical sensors in the pharmaceutical industry and scientific research laboratories can be expected to gain in popularity. References 15: 5 Russian, 10 Western.  
[2053-12172]

SYNTHESIS AND PHARMACOLOGIC STUDIES ON POLYFUNCTIONAL MACROHETEROCYCLES.  
PART 2. ANTIULCERATIVE ACTIVITY OF 1,2-BENZO-3,14-DIOXO-7,10-DITHIA-4,13-DIAZACYCLOTETRADECA-1-ENE

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 7, Jul 85  
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[Abstract] Outbred rats with experimental gastric ulcers induced by the administration of histamine or serotonin, or stress-induced, were treated with a novel agent--1,2-benzo-3,14-dioxo-7,10-dithia-4,13-diazacyclotetradeca-1-ene (I)--to test its efficacy as a potential antiulcerative. Intraperitoneal administration of I in a dose of 20 mg/kg in 1% starch paste prior to administration of the chemical agents or exposure to stress (immobilization in narrow cages at 20°C) reduced the number of animals that developed gastric ulcers to 2 out of 6, with a mean number of 0.3 ulcers/animal [sic]. Most control animals (5/6) developed ulcers, with a mean number of 6 ulcers/animal. A related compound, 1,2-benzo-3,14-dioxo-4,13-bis(2-carbomethoxyethyl)-7,10-dithia-4,13-diazacyclotetradeca-1-ene, was ineffective as an antiulcerative agent. References 11: 8 Russian, 3 Western.  
[2053-12172]

UDC 615.277.3.099.015.23

PROTECTION OF ORGANISM BY 2'-DEOXYCYTIDINE HYDROCHLORIDE ENCAPSULATED IN LIPOSOMES IN PROCESS OF EXPERIMENTAL ANTITUMOR CHEMOTHERAPY WITH CYTOSINE ARABINOSIDE

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 5, May 85  
(manuscript received 7 Jun 84) pp 561-565

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[Abstract] The promise of using liposomes as phagocytatable carriers for protector substances was demonstrated on the model of a developing T-cell EL4 lymphoma in mice. Experimental results show that intensive therapy of a developing lymphoma with the protection of a phagocytatable form of a protector utilizing liposomes as the carrier, the protective substance being a normal metabolite of the biosynthesis of nucleic acids, is more effective than chemotherapy alone or chemotherapy with a molecular solution of the metabolite. Administration of the metabolite with liposome carrier actually increases the antitumor effect of the antimetabolite while fully preventing toxicity. Figures 2, references 25: 13 Russian, 12 Western.  
[2069-6508]

# INDUCTION OF MICROSOMAL CYTOCHROMES IN RAT LIVER AFTER INTRAVENOUS ADMINISTRATION OF PERFLUOROORGANIC COMPOUND EMULSIONS

Moscow BIOKHIMIYA in Russian Vol 50, No 7, Jul 85  
(manuscript received 17 Dec 84) pp 1220-1227

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[Abstract] Examples of the use of perfluoroorganic compounds as gas transfer media in biology and medicine are widely known. A perfluoroorganic compound (PFOC) emulsion has been successfully tested as the major component of a blood substitute solution for both animals and man. This work studies some parameters of a cytochrome P-450-dependent monooxygenase system of rat liver microsomes after intravenous administration of emulsions containing various PFOC. The animals received 3 ml PFOC emulsion per kg body mass, then were sacrificed two to fourteen days after administration of the emulsion. The content of cytochromes  $b_5$  and P-450 in liver microsomal fractions was determined.

The results showed unambiguously that intravenous administration of relatively small doses of emulsion containing PFOC causes an almost three times increase in the content of cytochrome P-450 in liver microsomes. By ten days after administration of PFOC, the content of P-450 had returned to normal. The content of cytochrome  $b_5$ , rate of oxidation of NADPH and rate of hydroxylation of type I and II substrates by the microsomal preparation also increased. The intensity of NADPH-dependent peroxide oxidation of lipids in the microsomes decreased. Thus, the inert compound, which does not undergo chemical transformations in the organism, causes induction of liver monooxygenase enzymes. Figures 6; references 35: 8 Russian, 27 Western.  
[2068-6508]

UDC 616.155.2:616.981.25:546.41.001.6

# PARTICIPATION OF Ca-DEPENDENT SYSTEMS IN PLATELET AGGREGATION RESULTING FROM STAPHYLOCOCCAL TOXIN ACTION AND ADP

Moscow BIOLOGICHESKIYE NAUKI in Russian No 7, Jul 85 pp 23-26

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[Abstract] The aggregating effect of staphylococcal toxin and ADP was studied on rabbit platelet-enriched plasma as a function of the processes involved in introduction of calcium ions into a cell. The results showed that in the concentration used, ADP caused a definite aggregation of platelets which developed practically without any latent period, reaching a maximum after 4.5 min. Blocking of calcium ion channels in cell membrane by verapanil inhibited this aggregation by 40.9±5.2%. Under analogous conditions, the aggregating action of the toxin was suppressed only insignificantly. It could be concluded that

introduction of Ca ions into a cell through the slow channels is not a necessary step in the aggregating action of the toxin, the contrast to ADP. The transport of calcium ions into the platelets under the action of toxin is evidently brought through verapanil resistant channels forming in the membrane. Figure 1; references: 11 (Western).  
[2054-7813]

## PHYSIOLOGY

### PEPTIDES AND MEMORY

Moscow IZVESTIYA in Russian 1 Aug 85 p 8

[Article by L. Ivchenko: "Aids to Memory in Scientific Laboratories"]

[Text] The renowned naturalist and scientist Carl Linnaeus in his declining years had lost so much of his memory that he no longer recognized his own scientific works. In reading them he would exclaim: "How wonderful! If only I had written this!"

Why does this occur? Why can one person repeat practically every word read and remember them for many years, while another retains almost nothing? And why do people complain increasingly of forgetfulness as they age?

The mechanism of memory has always attracted the keen interest of scientists. This is no accident--the memory is, after all, the "cornerstone of mental development" (in the words of I. M. Sechenov), the "launch platform" of human thought. Several investigators believe that physico-chemical shifts occurring in the bodies of the neurons--the nerve cells of the brain--are responsible for the formation of memory. Others believe that it is the synapses--areas of contact between neurons--that are all-important. There are upwards of 10,000 such "points of contact" for a single neuron, hence the brain's ability to "write in" such colossal information. Scientists have also sought the center of the memory, believing it would lie in a certain section of the brain, but have not found it.

"It is because the memory is an adaptive reaction of the organism to the surroundings, and many substances and hormones are involved in this exceedingly complex process," says V. Klusha, director of the Laboratory of Molecular Biology and Pharmacology of Peptides of the Institute of Organic Synthesis of the Latvian Academy of Sciences. "In recording all our surroundings the brain selects the most important signals each minute from the avalanche of all possible information. Therefore the 'storeroom of the memory' is the entire brain itself. Naturally, there are more important sections and hormones that are more responsible for memory. Studies of recent years have shown that the



hormones of the hypophysis--corticotropin and vasopressin--the functions of which had been regarded as long-known, may appear in a completely unexpected role as memory stimulants. Which is what we are currently working on."

These are peptide substances. Peptides are "miniature proteins", short chains of amino acids, which have been found to exert a tremendous influence on the central nervous system. Some of these regulate sleep, others the feeling of hunger or thirst, still others alleviate pain and so on. They are truly ubiquitous: while each is responsible for its "sector" they also interact with each other at the same time, influencing the release of other peptides and other reactions. (In this way, equilibrium is reached in the organism). Hence the name of these natural bioregulators--neuropeptides.

They are all more or less involved in the formation of memory, but vasopressin and corticotropin in particular sharpen the attention and the learning ability. The Leningrad doctors V. Medvedev, G. Akimov and V. Bakharev have conducted an experiment testing the action of these neuropeptides on themselves. It turned out that corticotropin improves the short term and associative memory, vasopressin the long term.

Or consider another "human" test--a video tennis game. The screen shows a racquet and ball. The subject can simulate striking the ball by moving the handle. Once having learned this, he continues to play better, building up his score. Then the player is given a two day intermission. Without taking vasopressin he plays the same as at the end of the first day; with vasopressin, noticeably better. This test was conducted at the All-Union Scientific Research Institute for General and Forensic Psychiatry imeni Serbskiy for a quantitative evaluation of the speed of learning motor skills.

Vasopressin provides an effect of latent learning, scientists have observed. It is as though this peptide finishes the learning process by subconsciously using information that has been recorded, but not yet assimilated. Incidentally, vasopressin is of no use in remembering meaningless word combinations or absurd information; it is only effective in the solving of certain meaningful tasks, enhancing what is biologically or socially important to the organism. It also reinforces the alcohol avoidance reflex in treatment of alcoholism: the reflex is retained twice as long with use of this peptide.

It is also an ideal helper in emergency situations: barren wasteland, outer space, and mountains, for it speeds up adaptation. It concentrates the attention, reduces emotional stress and improves the heat regulation. Thus, the biosystem is brought into a condition of optimal readiness. The Leningrad doctors have proved this by testing the influence of vasopressin on themselves in mountain environments.

[Question] Will there be a pill someday for the forgetful?

"In time," answers G. Chipens, head of the department of peptide chemistry of the Institute of Organic Synthesis. "Preclinical study of a synthetic memory



hormone is now underway. We are analyzing its effectiveness and checking out models. For in order to develop a drug similar to a natural peptide it is essential to understand the basic mechanisms of its effect, the principles of its structure and, on occasion, even to "improve" its molecular formula. The very same vasopressin, with its diversified effects, may serve as the basis for different drugs. Let me show you."

Gunar Ignat'yevich holds up a pile of different-colored balls joined together and rotating in different directions, similar to Rubik's cube. The black balls are carbon atoms, the red ones oxygen, the blue nitrogen and the white hydrogen.

"This is a model of the molecule of the peptide hormone angiotensin," he explains. "And this is vasopressin. Notice how many of the fragments are common. But both of these regulate blood pressure and the water-salt metabolism. Could it be that these common fragments are responsible for the similar properties? And if we were to remove these from vasopressin? This has indeed been done. Thus new 'versions' of the peptide have been created. Vasopressin has had its hormonal properties removed and functions solely as a stimulator of memory, attention and learning ability."

But what impairs memory? As yet, science cannot exactly answer this question. All that we know is that certain drugs (in large amounts), improper nutrition and stress inhibit memorization. Lengthy nervous strain, in which our life unfortunately abounds, depletes the organism and its nerve system and disrupts the basic processes of protein metabolism.

"Stress, you know, increases the blood pressure and a mass of hormones are released into the blood" explains V. Klusha. "These are protective reactions: the organism is mobilized, throws all its reserves into the fray to deal with the situation and leaves itself defenseless. It is now difficult to emerge from this condition. The huge quantities of hormones and other substances begin to harm certain systems. Also, once its reserves are depleted, the organism is helpless against sickness, infection and cancer--it is believed that stress is largely responsible for the development of cancer. It is not easy for a person to restore their strength. The reserves build up slowly. And so we have depression, weakness, low resistance, the situation where 'every illness takes hold' as the saying goes. It is therefore very important to find a means of quickly neutralizing all these deleterious consequences. One such means is the peptides. The discovery of their regulatory properties has revealed immense possibilities of developing the necessary agents.

[Question] But aren't there a lot of tranquilizers?

[Answer] That's just the point. Nonpeptide drugs or antidepressants do not work immediately. But a peptide does, from the very first minutes. Moreover the peptides are natural compounds, nontoxic, with no side effects. They are broken down in the body to the same amino acids as the proteins of the food. We have developed such a potent and innocuous antidepressant at our institute. It will be the first such drug in the USSR based on a natural peptide.

The work in development of the future antidepressant is nearing completion. The project is under the direction of Viya Yekabovna Klusha, doctor of medical sciences and laureate of the USSR State Prize for work in the field of peptides, as a matter of fact. The peptide department of the institute's experimental factory is currently "turning out" materials for experiments and clinical testing. And even though the output is no more than several dozen grams, it may be regarded as sufficient: for peptides are effective in micrograms.

The first batches of pure chemical vasopressin are also being produced. This is not yet available in the country and is very much needed. It will become a cure for many illnesses and disorders, including the trauma associated with memory loss.

Peptide hormones are now being studied intensely here and abroad. New properties are being constantly discovered in them. Many of the medicines of the past, scientists are convinced, will come to be based on these natural bioregulators: fast-acting, high-potency, nontoxic and target-specific.

For the impatient who, after reading this article, will apply to the institute for help let us clarify that both the memory improvement drug and the antidepressant are not yet medications, but only experimental models. They must undergo confirmation and clinical testing before they can appear in the pharmacies and hospitals. Only after this will their manufacture be authorized. Thus, for the time being, we may speak of them as nothing more than scientific achievements.

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MITOCHONDRIAL MANIFESTATIONS OF STRESS AND RESPONSE TO HORMONAL STIMULATION  
AND HYDROAEROIONS

Moscow ZHURNAL OBSHCHEY BIOLOGII in Russian Vol 46, No 4, Jul-Aug 85  
(manuscript received 6 May 83) pp 516-526

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[Abstract] Biochemical studies were conducted on hepatic and cerebral mitochondrial suspensions obtained from Wistar and August rats to assess the effects of immobilization stress. The mitochondrial preparations exhibited the universal manifestations of the standard biphasic response to physiological stress, consisting of an initial enhancement of energy metabolism as reflected in increased succinate oxidation and elevated respiratory rate. These changes were consonant with an initial upsurge in epinephrine release into the blood stream. With ongoing stress, succinate oxidation shows a corresponding increase accompanied, however, by an even greater increase in an antithetical process--inhibition of succinate dehydrogenase by oxalacetate and the products of serotonin oxidation. Treatment of the stressed animals with lightly charged negative hydroaeroions ( $-OH$  particles separated from  $H_3O^+$  by Mikulin's generator) abrogated the latter effects, and resulted in an increase in mitochondrial respiration to above-background levels. The rapid change seen with the hydroaeroions was ascribed to electrobiochemical mechanisms responsible for enzyme activation. Figures 2; references 49: 28 Russian, 21 Western.  
[2052-12172]

DEMOGRAPHIC PROCESSES AND ORGANIZATION OF MEDICAL SERVICES FOR POPULATION  
OF GISSARSKIY RAYON

Dushanbe ZDRAVOOKHRANENIYE TADZHIKISTANA in Russian No 6, Nov-Dec 84  
(manuscript received 31 May 84) pp 80-83

[Article by M.A. Abdullayeva, Department of Social Hygiene and Organization of Public Health (director--Professor Ya.T. Tadzhiyev), Tajik State Medical Institute imeni Abuali ibn Sino]

[Text] At the current stage of economic and social development of our country, the study of the characteristics of population reproduction has acquired special significance and urgency. It is necessary to translate into cultural practices effective demographic politics, based on the resolutions of the 26th CPSU Congress, which will require from social hygienists and organizers of public health an in depth study of the demographic processes in their particular regions. This will allow the directors of organs and institutions for public health to organize more adequately the therapeutic-prophylactic services for the population. Based on the above, we have undertaken the task of defining the characteristics of basic demographic processes in the Gissarskiy Rayon of Tajik SSR.

The Gissarskiy Rayon is located at a distance of more than 20 kilometers from the capital of the republic, occupying a territory of 2,000 square kilometers. Kolkhoz and sovkhos units are distributed throughout the rayon. There are specialized sovkhos units involved in horticulture and animal husbandry, whose lands are not fit for cotton cultivation. However, the basic agricultural crop, cultivated in the rayon, is cotton.

In 1983, the population consisted of 181,405 people, of whom 19,809 were urban dwellers and 161,596 were farm dwellers. If, in the year 1970, the percent of urban dwellers among the entire population constituted 16, then in the year 1979, it decreased to 11, a change related to a more marked migrational process and one which is very important given the higher level of population growth on the farms. It is caused by a higher birth rate among farm dwellers in comparison with urban dwellers for 1981, 1982, and 1983: 43.4 and 43.3; 42.2 and 35.4; 42.2 and 38.8 (per 1,000 population), respectively. For the rayon as a whole, the birth rate remains at a very high level.

The high birth rate level leads to an increase in the juvenile population and multi-children mothers, with the average family size defined as "large" and "extra-large."

In the rayon during 1983, the relative significance of the juvenile population constituted 45.86 percent of the general population, a fact which leads to a significant increase in expenditures for maintaining children through their majority, for their education, medical care and so forth. It is necessary to note that a growth in population by 1 percent requires from the state a demographic investment of approximately 4 percent of the national income (B. Uralis, 1974). The high intensity of birth rate leads to a growth in the number of multi-children mothers. Thus, according to census data for 1979, the number of women, bearing 10 or more children in Tajik SSR, constituted 75,713. This is equal to 6 percent of the total number of women who fall in the age group of 15 years and older.

Таблица 1

Число и удельный вес женщин, родивших 10 и более детей, в зависимости от возраста (по данным переписи 1979 г.)

(2) Возрастные группы (лет)	(1) Женщины, родившие 10 и более детей	
	(3) число (в %)	(4) удельный вес (в %)
15-19	—	—
20-24	—	—
25-29	0,4	0,06
30-34	15,3	1,48
35-39	98,2	10,14
40-44	176,4	20,8
45-49	204,8	21,3
50-54	153,4	14,2
55-59	142,70	10,9
60-64	112,7	5,94
65-69	105,9	5,10
70 и более (5)	123,5	10,6

Table 1. The number and relative significance of women who bear 10 or more children in relationship to age (according to census data for 1979)

Key:

1. Women who bear 10 or more children
2. Age group (in years)
3. Number (in 0/00)
4. Relative significance (in 0/0)
5. And older

As is evident from table 1, the greatest number of women who bear 10 or more children are found in the age groups of 40-44, 45-49, and 50-54, groups which constitute 56.3 percent of the total number of women. On the average, these women have 11.04 children.

The data which we obtained attest to the fact that multi-children families in the Gissarskiy Rayon are far from the exception in the republic (see table 2).



Таблица 2

Численность семей с 10 и более членами в Гиссарском районе  
(по данным переписи 1979 г.)

(1) Население	(2) Годы	Число семей (на 1000 семей)	Средний размер семьи
(3)	(4)		
Всего (5)	1970	63	5,7
	1979	150	6,3
городское (6)	1970	28	4,6
	1979	47	4,5
сельское (7)	1970	71	5,9
	1979	168	6,6

Table 2. The number of families with 10 or more members in the Gissarsky Rayon (based on 1979 census data)

Key:

- |   |                        |
|---|------------------------|
| 1. Population                                 | 4. Average family size |
| 2. Years                                      | 5. Total               |
| 3. Number of families<br>(per 1,000 families) | 6. Urban               |
|   | 7. Rural               |

It is obvious from the above table that the size of families which have 10 or more members, based on the rayon as a whole, has grown by 138 percent, with the urban population growing by 67.8 percent and the rural by 136 percent. A tendency has also been noted for an increase in the average size of the family, especially among rural dwellers.

Thus, multi-children families are typical for this region, especially in the rural locales.

A complex social-hygienic study of this contingent of the population will have great significance for improvement in the effectiveness of activities of public health, education and social welfare organs.

In addition to birth rate processes, the general and infant mortality rates have a determining influence on the formation of a demographic situation. Although the general mortality rate in the rayon at the present time is at a low level (8.4 per 1,000 population), among rural dwellers this rate has increased from 7.6 in 1981 to 8.3 in 1982, data which concur with data found in the literature (M.S. Bednyy, 1979; M.A. Avasov, 1981). One should note that the infant mortality rate in the republic, despite a tendency toward decline, has exceeded the level of 1970 by 38.3 percent. In the Gissarskiy Rayon, it is also quite high, although a tendency toward decline has been noted (in comparison with 1981, in 1983 it fell by 15.3 percent).

The level of infant mortality is influenced by climato-geographic conditions, the level of general and public health culture of the population, traditions and habits which are expressed in the characteristics of child care, the tempo of family formation, the life style and the quality of medical services (M.S. Bednyy, 1979; R. Ignatyeva, 1983).

Improvement of therapeutic-prophylactic services will be more evident with a higher level of general and public health culture of the population. The



significance of shifts which occur in the level of education of the population of the rayon can be judged by the following data. Thus, the number of individuals who have had higher and middle (complete and non-complete) education in 1979, in comparison with 1970, increased by 112 percent, those with higher education increased by 146 percent; and those with mid-level education grew by 160 percent. Per 1,000 individuals of this population, there were 713 people in 1979 with higher and mid-level education. In turn, these tendencies will have a positive influence on the increase in general and public health culture, the formation of a healthy life style, improvement in the relationship of mothers to their own health and the health of their children, increase in the turnover at therapeutic-prophylactic establishments and realization of the goals of the dispensary system.

One should note that the material-technical basis for the therapeutic-prophylactic establishments of the rayon are adequately developed. Today, the medical services here include 88 therapeutic-prophylactic establishments including central and local rayon hospitals, 8 rural affiliated hospitals, 3 birthing centers, 2 dispensaries with hospitals (anti-tubercular and venereal), 22 rural outpatient centers staffed with doctors, 14 public health centers, 41 paramedic and midwife centers, sanitary-epidemiological stations and others.

According to 1983 data, 223 doctors and 796 mid-level medical personnel worked in the rayon. The utilization of doctors (also including dentists) constituted 12.3 and the use of mid-level medical personnel was 43.8 per 10 thousand population; the number of inpatient beds per 10 thousand population was 71.9.

Much has been accomplished by public health workers in the rayon for improvement of hospital equipment, adding modern diagnostic apparatus, increasing the staff of medical personnel at rural therapeutic-prophylactic establishments; a branch of the Dushanbe Secondary Medical School No 1 is in the central rayon hospital.

Future plans for development of public health services include the following: construction of a new building for the central rayon hospital (a polyclinic for 600 visits per shift, and an inpatient service with 600 beds) and a hospital (polyclinic with facilities for 125 visits per shift, and an inpatient service with 135 beds); completion of construction of a rural ushastok hospital at the Lenin kolkhoz; reconstruction of the uchastok hospital at the Moscow kolkhoz and opening of rural doctor-staffed outpatient clinics and paramedic and midwife centers.

Today, public health organizations in the rayon must allow for the demographic situation when organizing the therapeutic-prophylactic services for the population. Activities must be directed at improving the health of the population based on the characteristics of demographic processes in this particular region.

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## ANNUAL MEDICAL EXAMINATIONS FOR WORKERS AT INDUSTRIAL ENTERPRISES

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 6, Jun 85  
(manuscript received 12 Feb 85) pp 3-7

[Article by A. M. Moskvichev, chief of the Therapeutic and Prophylactic Aid Main Administration of the USSR Ministry of Health]

[Text] Regular medical examinations for the public are one of the most important, integral parts of disease prevention. Today health care organs and institutions and all medical personnel are faced with an important and serious task--making the gradual transition from regular health examinations for individual groups to annual health examinations for the entire population. The network of health care institutions is continuing to expand, constant improvements are being made in the staffing of these institutions and the availability of modern medical equipment, and the level of organization is rising. The planned capacity of out-patient polyclinic institutions has risen to 5 million visits per shift. In spite of this, introducing annual health examinations for the country's entire population is a fairly complicated task. For this reason, this problem should be solved by gradually including more and more new large groups of the population in the annual health examination system.

Workers in industry, construction, transportation, and communications should be among the first groups to receive the annual health examinations. This is based on the following factors:

--The importance of protecting and fortifying the health of citizens involved in the creation of physical assets;

--The high level of organization of labor collectives at industrial enterprises;

--The developed network of medical-sanitary units and health stations at industrial enterprises, and specialized departments and sections at territorial polyclinics;

--The possibility of using the enterprises' health institutions (sanatoria and preventive care centers, sports facilities, vacation centers, and so on) for measures aimed at primary and secondary disease prevention;

--The availability of large computer centers at many enterprises, which can be used to monitor the course of the health examination system, create a data bank on the health of the workers, conduct a multifactorial analysis of the incidence of illness and temporary disability, and on this basis, take measures to reduce these figures.

It should also be pointed out here that many industrial enterprises have gained considerable experience in annual preventive health examinations and in identifying individuals suffering from chronic illnesses or whose health is not up to the norm.

The prevention of disease and improving health are statewide tasks, and enterprise management, trade union committees, and Red Cross and Red Crescent organizations are all playing an active part in carrying out these tasks. Medical-sanitary units and territorial clinics carry the primary responsibility for organizing the workers' annual health examinations.

In recent years there has been continued growth in the number of medical-sanitary units, primarily as a result of the organization of large institutions that can provide out-patient polyclinic and hospital care in many different areas of specialization, and can take a comprehensive approach to resolving complicated problems of disease prevention, early diagnosis, and treatment. In addition, there has been a significant increase in the number of specialized sections and departments at territorial polyclinics. There are more than 19,000 specialized departments in the country, and more than half of them are set up in city polyclinics. The process of breaking up territorial therapeutic sections into smaller units is being completed, and this will help raise the quality of the therapeutic and preventive care provided by the polyclinics. In the 12th Five-Year Plan there are plans to bring the number of people working in specialized therapeutic services to 1600, which will create even more favorable conditions for carrying out the health examinations.

Annual preventive health care for workers at industrial enterprises, and for the entire population, should include the following measures:

--Annual medical examinations by physicians, with the participation of middle medical personnel and the use of modern laboratory instruments and functional studies;

--Additional testing using more sophisticated diagnostic methods, with the participation of various specialists;

--After individuals with risk factors for the development of a disease and individuals already suffering from a disease are identified, the necessary treatment and therapeutic measures are to be taken;

--Dynamic observation of those suffering from a disease with the aim of reducing the frequency of aggravation of the illness.

Unlike other groups in the population, workers at industrial enterprises, especially those employed at plants with difficult and hazardous working conditions, undergo preliminary medical examinations (when they are hired) and

periodic health examinations, the frequency and number of which depend on the specific nature of the working conditions and the job; this is in accordance with norms set by the USSR Ministry of Health, the USSR State Committee for Labor and Social Problems, and the All-Union Central Council of Trade Unions. When the entire population is covered by annual health examinations, and every person in the country will undergo a preventive medical examination with various specialists participating and with a given set of laboratory and instrument tests, on the basis of a list of plants and professions workers at industrial enterprises will be examined and undergo a certain set of additional tests, depending on the working conditions, with the aim of detecting the earliest signs of occupational illness. Every year the shop physician or chief of the health station should determine the thoroughness of the preventive medical examination required for each individual worker, taking into account job factors and the individual's health condition on the basis of data from the preceding medical examinations.

There will be no difference in the additional examinations provided for the population as a whole and for workers at industrial enterprises. Consultation-diagnostic polyclinics at medical VUZes and scientific research institutes and large hospitals, specialized departments, including occupational illness departments, hospitals, and other health care institutions will be used to conduct the additional examinations.

The experience of many medical-sanitary units that have performed preventive medical examinations of workers at enterprises shows that 50-70 percent of all those examined are healthy, 10-20 percent are healthy for all practical purposes, 13-17 percent are in the compensation stage, 4-6 percent are in the subcompensation stage, and fewer than 0.5 percent are in the decompensation stage [3].

Therapeutic measures for individuals suffering from certain abnormal health conditions are carried out on the basis of general principles and consist of treatment in out-patient polyclinics and hospitals, the provision of special dietary meals, and passes to sanitarium-spa facilities, rest centers, and medical and preventive care centers. Many enterprises have their own treatment complexes. For example, the Metallurgical Plant imeni S. M. Kirov in Donetsk Oblast has a special health section. "The section includes 15 social and cultural facilities (rest centers, pioneer camps, a children's summer house, a palace of culture, a medical-sanitary unit, a cultural park, a preventive health care center, a library, etc.) and sports facilities (a swimming pool, playing fields, a gymnasium, etc.)" [1]. The health section plays an important role in fortifying the workers' health, in the maintenance and reproduction of manpower, and in the campaign against work time losses. There are over 30 shops of this nature in operation just at enterprises in the metallurgy industry in the Ukrainian SSR.

It is the task of health care organs, chief physicians at medical-sanitary units and city polyclinics, and trade union committees to ensure more rational utilization of the vast network of sanatoria and preventive care centers. More special programs should be set up at these facilities, such as "Mother and Child" programs, and the dietary meals provided there should be improved.



Inadequate use is being made of sanatoria and preventive care facilities as recuperation centers for workers right after they are discharged from the hospital or when they are on temporary disability. According to data obtained by G. F. Yemelyanova and I. N. Kutuzov [2], respiratory diseases account for the largest proportion of illness among workers, followed by accidental injuries, nervous system disorders, and diseases involving the sensory organs; this means that a significant portion of those suffering from some illness can undergo treatment at sanatoria and preventive care centers without taking leave from work.

During the dynamic observation of individuals who have been identified as ill, and when carrying out all the measures aimed at preventing the aggravation of the illness, and when possible, at complete recovery, working conditions absolutely must be taken into consideration, along with the need to improve them. Special attention should be given to groups that are frequently ill and ill for prolonged periods.

The shift to annual medical examinations for workers at industrial enterprises will require the introduction of many new organizational forms for therapeutic and preventive care that have proven themselves at a number of enterprises and promote a stable decline in the incidence of illness accompanied by temporary disability and an initial assignment to invalid status. At industrial centers in Donetsk Oblast special polyclinics for preventive examinations have been set up to provide comprehensive preventive exams for workers; this is helping to increase the detection of illnesses by a factor of more than 2 [4]. Without denying the effectiveness of institutions of this nature, it should be pointed out that preventive and therapeutic measures are coordinated more closely at preventive care departments in medical-sanitary units and city polyclinics. There are about 600 preventive care departments (offices) functioning at out-patient polyclinic institutions throughout the country. The experience at the preventive care department at the medical-sanitary unit of the "Motorostroitel" [Engine Builder] Production Association in Zaporozhye should be introduced on a widespread basis. The department uses modern medical equipment, the system for providing preventive medical exams is well organized, with each patient spending no more than 1-2 hours on the examination; and when necessary, the full range of therapeutic measures can be carried out. A computer helps monitor the course of the examinations and the quality of the system.

Persistent efforts are still being made to find optimal ways to use computers to reduce the time spent on conducting the examinations and on automation of their elements. The automated consultation and diagnostic center of the medical-sanitary unit in operation at the "Kommunar" plant, after some refining of the examination technology, will serve as a model for medical-sanitary units at large enterprises. Introduction of the comprehensive automated system for medical examinations, developed by the Latvian SSR Ministry of Health in conjunction with a number of health care institutions, at enterprises and city polyclinics looks very promising. The merits of this system include simplicity and accuracy of the questionnaire results and the use of the "Iskra" microcomputer; this computer does not require complicated technical care, which means that middle medical personnel can use it.

A number of systems for the automated diagnosis of illnesses are now being developed and are in the testing stage. Many of the developers are offering complexes meant to detect a particular group of diseases (cardiovascular, oncological, etc.), and even individual diseases, such as ulcers and bronchial cancer. These systems are useful for in-depth epidemiological research and the study of the incidence of noninfectious illnesses. However, in an annual medical examination it is not possible to first study heart disease, and then pathologies of the respiratory organs, digestive organs, and so on. This takes quite a lot of time and requires additional personnel, and leads to inefficient utilization of expensive equipment. These systems should be used in the supplemental examinations.

Regular preventive examinations for workers are an integral part of all the health promotion work that is being done by the management of enterprises, medical personnel, and trade union committees. Medical engineering brigades are making a major contribution to reducing the incidence of illness. They first appeared at enterprises in Chelyabinsk and Sverdlovsk oblasts in the RSFSR, and in the Ukrainian SSR, and they work to eliminate a number of factors on the job that contribute to the development of illnesses. Those medical engineering brigades that are uncovering and eliminating factors contributing not only to injuries on the job, but also at home, and that are working systematically for more complete and efficient utilization of the enterprises' health facilities, should be praised.

The gradual transition to annual medical examinations requires that people working in the health care field resolve a number of other problems as well. Therapeutic and preventive care institutions are still being provided with modern medical equipment, but it is not being used as efficiently as possible. For example, at a number of institutions the electrocardiographs, endoscopes with fiber optics are used at only 20-30 percent of their capacity. Modern laboratory equipment, including fully automatic and semi-automatic equipment, is not used at anything close to its full capacity. The concentration of sophisticated equipment at therapeutic and preventive care institutions, the creation of centralized laboratories, large departments for functional diagnostics, endoscopy, and so on, require that physicians, starting with the shop and section general practitioner, have certain technical training, and the ability to evaluate test results properly. Efforts to raise the qualifications of physicians and middle medical personnel involved in the preventive examination system should be aimed at expanding their knowledge in the area of sound nutrition, healthy lifestyles, and the effect of the environment and occupational factors on a person's health.

The gradual transition to annual medical examinations for the entire population, including workers at industrial enterprises, is a complicated task. However, expanding the network of therapeutic and preventive care facilities, improving the staffing of medical personnel, and providing them with modern medical equipment will make it easier to meet this goal.



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## SUGGESTED CHANGES IN REQUIREMENTS FOR ADMISSION TO MEDICAL SCHOOLS

Moscow PRAVDA in Russian 12 Aug 85 p 3

[Article by N. Karkishchenko, Professor and Dean of Medical Institute, Rostov-on the-Don: "Who Should Become a Physician?"]

[Text] How does one start on the path to a medical degree? The first step is to take the entrance examinations to a medical institute. How do those examinations differ from entrance exams for any other VUZ? There are practically no differences. At the same time, we know that mastery of any profession cannot be accomplished by desire alone. No one is surprised by the rigid competitive health requirements which applicants must meet.

Well, what about a physician? What are the requirements that must be met by the person who has selected this profession? I'll tell you this much: it is a special profession. The physician is entrusted with our health. And this says it all. There is nothing more dear in the world than a human life. Compassion and responsiveness, endurance and self-possession, selflessness and a readiness for self-sacrifice -- all of these things describe the physician.

That is why we associates of medical institutes are so concerned about the selection of those persons who go "into medicine." Who will take the Hippocratic oath? Will the oath be taken hypocritically or with the full awareness of one's personal responsibility?

Four years ago Vladimir Kravtsov entered the preparatory division of our institute. He is now a fourth year Party organizer. He was a commander of a student construction detachment. He is a good student. He is seriously preparing himself for his future profession. But his road to the institute was a rather difficult one. He matriculated several times, and each time he failed. His grades were not up to par. He served in the Soviet Army, and later worked as a paramedic in a first-aid brigade. Of course, Volodya learned about life well, and we are certain that he will be a splendid physician. But here is the question: Did the first-year students before him deserve to be at the institute?

It's fine if the matter ends up like the following example. A young man has passed his entrance examination, and suddenly makes a request of the professor: "Please, give me a two grade."-- "Why?" --"I'm not suited for

medicine, but my parents want me to become a physician."

We shall say directly that far from all students are that frank. For some, it makes no difference what institute they get into. For others, there are certain other motives that are more important than the desire to be useful to the cause of public health.

And then there are still others. We were compelled to dismiss the graduating student Sergey I. from the institute. This young man was to have become a surgeon in several months, but the departmental chair demanded his immediate dismissal. What happened, then? Sergey grew up in a medical family. He graduated from school with a gold medal. He entered a technical VUZ. He quit that and entered a medical institute. He studied well for five years and dreamt of becoming a surgeon. However, in the last year of training, on more than one occasion he did not do well at the operating table. Upon viewing the body which he was about to touch with a scalpel, his hands became numb. He was never able to overcome that incident. This difficult case once again confirms the thought that desire alone is not enough to become a physician.

The collective of our institute is trying to find "our own" type of graduating student. This is not such a simple process. Future students must go through painstaking professional orientation. Our associates are participating in the work of "school academies," "Young Medic" clubs at Pioneer Homes and at the medical institute itself. We also visit inter-school regional professional centers.

We are giving particular attention to bringing rural students into the VUZ. This is of fundamental importance since there is a shortage of physicians in the rayons. And let us be frank: Who would be more willing to go the rayons? Former rural residents. They know the country better, there is a lot there that is dear to them, and the rural life style would not be new to them. Associates of the Institute frequently visit the rayons and meet with Party and soviet personnel and farm supervisors. In their turn, they have frequently been our guests. The number of kolkhoz and sovkhoz stipend recipients in our institute has been increasing.

But this is not enough to satisfy the rural need for medical personnel. So, we have taken the following step toward seeking "our own" type of graduating student. In Rostov on-the-Don there is a boarding school No. 85. It occurred to us: could not one "medical" class be organized there? The Party obkom, the oblispolkom, and the oblast education department came to our assistance. It has now been several years that we have had the ninth grade of this school comprised of pupils who live in remote rural regions. We select them at the recommendation of the local organs.

Why did we conclude that we needed to start a "medical" class? We were convinced that the youngsters who come from the villages are also most often the ones that fail the entrance examinations. The general education

preparation of rural pupils is often lower than that of urban school graduates.

We have attempted to eliminate that discrepancy. Classroom activities in the "medical" class are conducted by teachers in concert with our literati, physicists, and biologists. We have worked out a program of elective courses. Little by little, we are inculcating the profession into our wards. They visit hospitals, clinics, operating rooms, and even a "dissecting room." I am not afraid to say that we are fulfilling the social order of the countryside. Moreover, so far, the youngsters selected for the "medical" class have only been from the northern and eastern rayons of the oblast, where the need for medical personnel is the greatest.

People might ask: What are the chances of pupils from the "medical class" getting into the institute? We now have over one hundred graduates of that class studying at our institute. All of them are successful students and reliable persons. The rural hospitals will be getting good reinforcements.

The pupils and students with whom we are working today will be working at least in the first third of the 21st century. Hence, the great social responsibility of higher education personnel is to prepare the specialists of the future. The decisions of the Party and Government concerning further improvements in the training and retraining of personnel and the general education and professional school reforms, compel us to think about the need for significant transformations in higher education, including medical education. And in my opinion, those transformations should begin with changes in the rules of admission.

Up to now, the system of admission examinations at best duplicate, and at worst, revise the secondary schools. The entrance examinations identify the candidates' general store of knowledge within the limits of the school program. The only difference between the entrance examination for the institute and the graduation examination in school is a great deal of psychoemotional stress.

But does it suffice to evaluate a future physician only by how strong he is in the subjects he studied at school? To illustrate that point I shall cite the data of an anonymous questionnaire distributed to current matriculants. Forty-seven percent of the entering students believed that they had all the qualities essential to becoming a physician. Thirty-seven percent thought they did not have all the necessary qualities, but hoped to develop them in the future, and 16 percent were not able to judge themselves and answered "I don't know." Only 42 percent named kindness and the ability to be compassionate as the most important qualities of a physician, and 36 percent thought that a high level of professional training was the important quality...

A more correct evaluation of a physician's essential professional qualities are given by young men and women who have already worked at therapeutic institutions. They know about the difficulties of the profession from

personal experience in everyday practice. Indeed, the scholastic progress of such students is significantly better than that of school graduates. Three-fourths of former nurses and hospital orderlies are making no less than "excellent" or "good" grades.

This year the admissions commissions have been given the right to admit persons to medical institutes who have worked two or three years at health institutions, without taking entrance examinations. It seems to us that this practice might also be applied to laboratory technicians, laboratory assistants in various services of the health system, medical institutes, and medical scientific-research institutes.

We believe that a special examination should be introduced for those persons who do not have any medical training. The examination should consist of two parts -- a practical and theoretical. The practical part would require all those who have not yet had any medical work experience to work for a certain period of time in large divisions of city hospitals and to undergo a practical program of general patient care. Such persons would be evaluated by medical personnel at the base hospital and institute instructors. The theoretical part would be a competitive interview which would primarily consist of questions about which the applicant must be knowledgeable in order to matriculate at a VUZ. The purpose of such examinations is not so much to find out how knowledgeable is the person entering a VUZ as it is to determine whether or not he will be able to use his skills in resolving specific situational tasks. Skillfully selected tasks will help detect a person's capability of "medical" thinking.

Of course, this does not exclude serious schooling in other subjects, but rather is a logical supplement to them. We even now are broadly utilizing the services of school teachers for conducting entrance examinations. Perhaps, it would pay for commissions appointed by national education departments to verify scholastic skills in physics, chemistry, biology, and literature.

It seems that it would be useful for the USSR Ministry of Health and Ministry of Higher and Specialized Secondary Education to commission several major medical VUZ's of the country to apply the already adopted principles of professional selection to the preparation and testing of a new way of organizing entrance examinations and primary adaptation to a future profession.

In one of his publications, the well known scientist Professor N. Amosov wrote about himself in the following way: "Surgery -- is my destiny!" Subsequent improvements in the work of higher medical education must be directed toward the goal of making this remarkable profession the great destiny of every physician.



# MEDICAL SERVICE RESPONSE TO PATIENT NEED AT TALLINN HOSPITAL

Tallinn SOVETSKAYA ESTONIYA in Russian 31 May 85 p 3

BALEVA, R.

[Abstract] Vello Ilmoya, Chief Physician of the Tallinn Pelgulin Hospital, describes in detail patient categorization, specialist availability, further staff needs for complete preventive medical care and programs which are conducted to encourage school children to study medicine or nursing. Measures to improve the psychological microclimate, lectures to patients by health and sanitation specialists, introduction of ultrasound diagnostics in obstetrics, a new Department of Medical and Family Consultation, ultrasound sterilization of instruments and new diagnostic and treatment procedures are being used to improve the Hospital's service to patients. Space limitations is the biggest problem currently facing the Hospital. Improvements in stomatology and physical therapy are also needed.  
[380-12126]

UDC 616-084:008

# COMPREHENSIVE APPROACH TO SOLUTION OF PRIMARY PREVENTION PROBLEMS

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 6, Jun 85  
(manuscript received 3 Oct 84) pp 7-10

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[Abstract] Primary prophylaxis was defined as a system of measures directed at preservation and improvement of health through liquidation, neutralization or decrease of undesirable effects of the environment and irrational life style. Because of the fact that considerable labor loss results from taking care of sick children, a social-clinical study was undertaken of the health and life-style of frequently sick children. Analysis of the data showed that during the first six years of life, these diseases occur most often without any seasonal pattern. These children showed lower indices of nonspecific immunity, dysbacteriosis and pathological changes in the nasopharynx area. The immediate family of such children suffered from repeated acute respiratory viral infections. To solve these problems, health improvement groups were organized in

day-care centers and during summer months, mothers of frequently ailing children were sent to sanatoria. In addition, physiotherapy personnel were introduced at these health improvement groups. As a result, child sickness was lowered by 40% and net savings of over 200,000 rubles were realized. The second program undertaken included children with gastroenterological diseases. A similar action also led to significant improvements. Finally, epidemiological data identified additional life style factors associated with these groups: smoking parents, lack of regular physical training, limited rest periods in open air. To improve their life style, lectures were given to selected parents.

References 4 (Russian).

[2042-7813]

UDC 362.121(470.311-25)

#### WORK ORGANIZATION AT DEPARTMENT OF PROPHYLAXIS IN MUNICIPAL OUTPATIENT CLINIC

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 6, Jun 85  
(manuscript received 16 Nov 84) pp 10-12

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[Abstract] Moscow Polyclinic No 151 services a population of 50,000; 750 visits are recorded per shift with two shifts operating daily. In 1981 this polyclinic opened a prevention department in which periodic screenings of the population are carried out. It includes the following offices: pre-physician reception; anamnesis, fluorography, x-ray, control work and physician's examination office. Women undergo annual Pap smear tests here. In the anamnesis office, early detection of arterial hypertension is attempted. The control work consists of careful registry of all workers with annual follow-up system for physical examination, the goal being to involve the entire population in annual multiphasic screening.

[2042-7813]

UDC 616.89-008.441.13:313.13

#### EFFECT OF ALCOHOLISM ON MORBIDITY WITH TEMPORARY LOSS OF WORKING CAPACITY

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 6, Jun 85  
(manuscript received 13 Nov 84) pp 23-26

KISPAYEVA, ZH. K., All Union Scientific Research Institute of Social Hygiene and Organization of Public Health imeni N. A. Semashko, USSR Ministry of Health, Moscow

[Abstract] The goal of this study was to evaluate the spread of somatic pathology among chronic alcoholics in relationship to the stage of disease and to show the effect of alcohol abuse on the level and structure of the disease along with the loss of productivity. The study was carried out at one of the large industrial plants of Karaganda. A definite relationship was found

between the degree of alcoholism and severity of diseases and loss of work days. The first degree alcoholics suffered primarily from respiratory ailments. The II and III degree patients exhibited increased levels of tuberculosis, urogenital problems, cancer, chronic ischemic heart disease and high level of suicides. Average age was 30, 45 and 52 years for the I, II and III degree alcoholism, respectively. Physicians should pay attention to patients with indications of alcoholism, isolating them into a special treatment group with consultations from experts in addictive problems. References 7 (Russian). [2042-7813]

UDC 362.1+616-082](477.86-22)

#### IMPROVEMENT IN MEDICAL SERVICE TO RURAL POPULATION

Moscow SOVETSKOYE ZDRAVOOKHRANENIYE in Russian No 6, Jun 85  
(manuscript received 15 Oct 84) pp 48-53

STUKAL, V. S., Ivano-Frankovsk Oblast Health Division

[Abstract] Living conditions of the rural population in the Ivano-Frankovsk Oblast improved substantially during the Soviet administration. After thorough demographic analysis, special measures were undertaken to improve the health status of the population: specialized medical help was organized (cardiology, oncology): first aid help was provided through ambulance service in many cases equipped with medical help. Women and children consultative service was established. The hospital bed capacity almost tripled in 15 years. In half of the regions, well equipped hospitals are now functioning; the population size serviced by one outpatient clinic dropped from 8,000 to 4,900. Preventive measures are being applied widely, including annual screenings. Central rayon hospitals are now connected with the oblast hospital by a teletype equipment to improve coordination and flow of information. Ivano-Frankovsk Medical School supplies 75% of all physicians employed in the Oblast. The results of these improvements are gratifying: pediatric mortality decreased by 32.2% in 12 years. [2042-7813]

MENTAL ANOMALIES AS OBJECT OF CRIMINOLOGICAL STUDY

Moscow SOVETSKOYE GOSUDARSTVO I PRAVO in Russian No 5, May 85  
(manuscript received 4 Nov 85) pp 74-80

[Article by V.V. Korolev, Docent II of the Moscow State Medical Institute and candidate in medical sciences: "Psychic Anomalies as the Object of Criminological Study"]

[Text] The problem of the crime-generating element of mental deviations<sup>1</sup> is determined chiefly by their possible influence on the motivation of crimes. Since the prevalence of mental anomalies in the individuals who commit crimes is fairly high, this problem acquires particular importance. Nevertheless, development of it is far from complete, in spite of the large number of studies that have been conducted. The numerous discrepancies and contradictions<sup>2</sup> of opinions of researchers bear witness to that. The most substantial are contradictions pertaining to the structure of mental anomalies, their crime-producing role and the features of illegal actions by mentally inferior individuals. For example, the figure for the prevalence of chronic alcoholism among individuals with mental anomalies in prison facilities, according to the data of Yu.M. Antonyan et al (1979), comprises 16.06 percent<sup>2</sup>; according to the data of L.K. Khokhlov (1974), this figure is higher by more than two times (33.99 percent)<sup>3</sup>. V.P. Yemel'yanov reports that of juvenile criminals with mental deviations, 51.1-66.7 percent are oligophrenics; K.A. Bayukov and his coauthors (1975) did not discover any oligophrenia in convicts<sup>5</sup>, and Yu.M. Antonyan et al., diagnosed it in 7.64 percent of observations. V.P. Yemel'yanov comes to the conclusion that oligophrenics are predisposed to commit mercenary crimes; Yu.M. Antonyan and coauthors say that oligophrenics are inclined to commit rape, and O.I. Kalganova (1982) established that oligophrenics do not commit rape at all<sup>6</sup>. The same sorts of discrepancies exist in relation to other clinical and criminological characteristics.

Difficulties in choosing an adequate study group make it hard to obtain reliable data. The impossibility of using medical documentation pertaining to the period before sentencing, which unavoidably reflects on the quality of diagnosis, is a shortcoming in continuous inquiries on inmates of prison facilities. Besides this, in such investigations those individuals sentenced to punishments not involving imprisonment drop out. Investigations conducted at legal-psychiatric hospitals are distinguished by a high quality of diagnostics; their shortcoming is the inevitable use of a selective method, a consequence of which is that

many typical commonplace observations are lost from them. The results of such investigations make it possible to describe the character of individuals undergoing examination at a legal-psychiatric hospital, but not the population of offenders as a whole.

Difficulties connected as well with the need for the detailed study of clinical and criminological problems, such as establishing the fact of the coexistence of criminal behavior and mental pathology, do not allow a conclusion to be reached about the presence of a cause-and-effect relationship between the given phenomena. It is well known, for example, that mental anomalies are fairly widespread among vuz [institute of higher education] students, certain types of pathology predominating among students of various departments<sup>7</sup>. However, this does not signify that just such anomalies condition matriculation to a vuz and choice of a certain department. Violators of the law have a significantly more widespread deviation not only from the mental, but also from the somatic (physical) norm--affectations of the teeth and organs of hearing and sight; diseases of the organs of respiration and blood circulation, etc., are much more frequently observed among delinquents<sup>8</sup>. Naturally, this does not provide grounds for supposing that treatment, for example, of bronchial asthma or chronic pneumonia in an offender would reduce his social danger. The case with mental anomalies is analogous. In order to determine their significance in criminology, fundamental studies are required that would be conducted simultaneously from medical (psychiatric) and legal (criminological) perspectives.

The features of mental anomalies in competent offenders were studied by us in terms of materials from outpatient legal-psychiatric examinations for minors. Included in the study were all psychologically competent inferior minors that had undergone outpatient examination in a certain region over the course of several years. Continuous study specifically of outpatient material allowed results to be obtained which were more complete and which more accurately reflected the situation in the general population, since more characteristic "commonplace" observations make up the basis of the study group. Analysis of psychological anomalies allows the following to be picked out as their most typical features.

1. The great diversity and polymorphism of psychological deviations. In more than one third of those investigated (36.4 percent) psychopathic deviations were observed with various degrees of manifestation, in approximately one fourth (24.0 percent)--intellectual impairment (mild retardation) and in 39.6 percent--other types of deviations, a significant part of which are made up of asthenic phenomena (increased fatiguability, weakness, sleep disturbance, moodiness, etc.). The heterogeneity of manifested anomalies testifies to the fact that the criminal behavior of psychologically inferior individuals is not a prerogative of any one form of pathology, which in turn says something about the absence of close, direct ties between mental illness and crime.
2. The predominance of preclinical (subclinical) and suppressed, underdeveloped variants of anomalies. The term "preclinical (subclinical) states" in psychiatry denotes phenomena that at the given stage have not yet reached the degree of an official disease entity (that is, illness). Their presence indicates only the increased risk of the emergence of disease which, however, is by no means universal.



These states may be attributed to the sphere of pathology only conditionally, taking into consideration the possibility of their developing into disease. Preclinical states were noted in 28.4 percent of those investigated. Those being tested with suppressed and infrequently expressed anomalies are closely affiliated with the given group. Besides the above-mentioned asthenic manifestations, neurotic and neurosis-like states (predominance of a worried mood, phobias, stuttering, isolated compulsions, etc.) and others may be added to their number. Summarily, preclinical (subclinical) and suppressed variants of psychological anomalies comprise 52.3 percent of those investigated. In many of those investigated, preclinical and suppressed deviations do not display a tendency to growth or deepening and do not reach a clinical level over an indefinitely long period of time. In the study group with relatively massive, developed variants of anomalies, the extreme rarity of severe, serious forms of psychological pathology, which would be on the border of competence, or at least near it, draws attention to itself. The observations conducted show that there is no direct dependency between the degree of expression of psychological anomalies and a predisposition to crime.

3. The clinical development, dynamics, and sometimes origin as well of mental anomalies is in many observations connected with alcohol abuse. Systematic alcoholic intoxication has been established in more than 40 percent of observations. This circumstance prevents the assimilation and disappearance of existing mental anomalies, and in many cases promotes their deepening. Systematic alcohol abuse is also one of the factors causing demoralization of the personality and its general antisocial trend. Thus, the problem of mental anomalies and criminal offenders is to a significant degree one of narcology.

4. Mental anomalies (phenomena of a clinical and preclinical type) in criminal offenders is in every case combined with phenomena of a non-clinical character--with social-psychological deformations of the personality. The personality of a mentally inferior criminal offender may not be defined only by means of its existing mental deviations. This position becomes still more obvious if one considers that in the majority of criminal offenders mental deviations are marked by suppression and a small degree of expression. Such anomalies are not the main factors determining the life goals, ideals and features of the individual's world view. Together with morbid deviations, in the structure of his personality there will certainly be manifested qualities not having a direct relation to psychopathology: a disposition toward idle pastimes, parasitism, aspiration to get rich without working, violence, conviction of being able to do anything with impunity, egoism, opposition of one's own interests to those of the people around one, a position of self-justification in any situation, etc. These qualities differ fundamentally from manifestations of psychic pathology (or prepathological conditions), also from manifestations of psychopathy.

In the most widespread forms of psychopathy (excitable, epileptoid, hysterical, unstable, inhibiting) such qualities are observed as a quick temper, increased contentiousness, pedantry and a tendency to dwell on trivia, suspiciousness, grotesque fundamentalism and straightforwardness of behavior, emotional immaturity and, connected with it, ostentation in actions, a striving for bravado, posing, shyness, a tendency toward passive-defensive reactions, increased inhibition and vulnerability, insecurity in the appropriateness of actions and importunate

striving constantly to validate them, inability to work out a stubborn stereotype of behavior, flippancy and inexplicable mood swings. Unlike social-psychological deformations, these traits are directly caused by peculiarities of higher nervous activity in psychopathies, such as: weakening of the process of excitement or inhibition and disrupting the balance between them, their pathological mobility and inertness.

Depending on the form of psychopathy and the range of psychopathic characteristics, various types of deviant behavior can be observed in psychopathic personalities. Owing to their existing characterological disruptions, psychopathic personalities easily create conflict situations around themselves, groundlessly pretend to the role of leader in a microsocial environment, display stubbornness and importunity, carry on intrigues, easily come under the influence of those around them, fantasize, lie, change their views and convictions, display incompetence for sustained volitional effort and shirk in any complicated everyday situations. Such forms of behavior disrupt the contact of the individual with the collective and keep him from adapting to the demands of the surrounding social environment. The most important symptom of developed psychopathy is the disruption of social adaptation caused by psychopathic disorders<sup>9</sup>. The unsociability of psychopathic personalities often creates constant friction in the collectives they belong to (family, labor or academic collective, informal surroundings). At the same time, as Ye.A. Popov fairly notes, many psychopaths "live peacefully and calmly, causing no kind of unpleasantness to other people"<sup>10</sup>.

But also when expressed contentiousness exists in psychopathy, in the overwhelming majority of cases it does not reach an extreme degree. Psychopaths usually live in families. They graduate from educational institutions and hold down socially beneficial jobs. Exceptionally rarely they turn out to be incapable of working and are put on disability. One should keep in mind that in recent years psychopathic manifestations have become less expressed and suppressed and undeveloped<sup>11</sup>. All this provides a basis for relating the chief mass of psychopathic manifestations to socially permissible (in the terminology of V.N. Kudryatsev<sup>12</sup>) and lawful, although negative and undesirable in the social scheme, behavior.

Mental anomalies that do not exclude competence do not come near turning a person into a robot incapable of adopting and adhering to social and legal norms. They acquire crime-generating significance only in combination with personality changes of a non-pathological character (social-psychological deformation). Often non-pathological but socially negative personality traits and manifestations of psychopathy or other anomalies may be closely intertwined within the framework of one personality, forming a unified whole. They may also exist as isolated, heterogenous formations that do not have reciprocal relations or they may neutralize one another's effects. In accordance with this, mental anomalies may further the commission of crimes, may have no effect on it, or may prevent it. The degree of expression of social-psychological deformations depends not only on the severity of mental disorders; the dynamics of these two types of personality deviation are not identical. For example, when mental anomalies are expressed there may be growth of social-psychological deformations, etc. The given situation has essential significance for the solution of the problem of using treatment measures to combat the criminal natures of mentally disturbed

individuals. According to many observations, improvements in clinical condition that are brought about by treatment may not reduce an individual's propensity for criminal activity, and may even increase it.

In a competent individual, the tendency toward crime cannot be examined as a symptom of an existing mental disorder. The crime-generating, non crime-generating or neutral effect of mental anomalies in a crime situation is realized only in combination with other factors, which cause crimes to be committed by mentally normal people. Therefore, in determining the crime-generating significance of mental deviations, one may talk only about the degree of their influence on the motivation of criminal acts.

A significant burden of crime-producing factors showed up in all those investigated (perversion of moral-ethical personality traits, systematic staying in informal, antisocialy-inclined groups, a lengthy period of antisocial behavior before the crime, etc.). The conclusion on the secondary role of mental anomalies is upheld in the study of the structure of criminal behavior in various forms of mental pathology. Mathematical processing of the results obtained has shown that there is not a statistically reliable dependency between the type of anomaly (psychopathic, intellectual, neurosis-like, asthenic and other deviations) and the various types of criminal activity (mercenary, mercenary-violent, violent, sexual, etc.).

A comparison of the structure of the criminal actions of individuals with and without psychopathic deviations, with and without intellectual disorders and with both massive forms of mental pathology and suppressed, mildly expressed types of mental anomaly did not bring to light substantial differences. The single difference was established in comparing the structure of the criminal actions of individuals who systematically underwent alcoholic intoxication with those of individuals who did not abuse alcohol. Systematic alcoholization closely correlates to the commission of violent crimes.

A study of the motivation of criminal actions. In terms of the group as a whole, mental anomalies played a crime-producing role in 22.3 percent of those investigated, a neutral one in 63.3 percent and an anti-crime one in 14.3 percent. This says that they further the commission of crimes in less than one quarter of those criminal offenders with mental anomalies. The crime-generating influence of anomalies appears most sharply in personalities with psychopathic deviations when they commit violent, so-called situational crimes, which are characterized by the emergence of a particular situation, by the sudden appearance of an intention and its quick realization and by a lack of time to consider one's actions.

Such crimes were observed in 17.7 percent of criminal offenders with psychopathic deviations and in only 4.2 percent of offenders without symptoms of psychopathy. So-called affective crimes and "crimes with inadequate motivation"<sup>13</sup> were observed significantly more often in psychopathic subjects. In this, a coincidental situation provokes the appearance of the weak, damaged sides of the offender's personality, which are caused by his existing psychopathic deviations. In all these observations "psychopathic motive" appeared directly as either a fundamental or an additional motive for the crime<sup>14</sup>.

Thus, in a criminological sense psychopathic deviations are of great interest<sup>15</sup>. Their influence is most substantial in situational (for the most part violent) crimes. However, situational crimes, in which the crime-generating role of mental anomalies is manifested, comprise less than one fifth of the crimes committed by individuals with psychopathic deviations. In the others, at the moment the crime is committed mental anomalies exert no substantial influence or even have an anti-crime effect.

If the role of mental anomalies were reduced to specific crime-generating influences in certain conditions where individual-personality and situational factors "went together like lock and key", the problem of the crime-generating properties of mental disorders would demand a great deal of attention. The chief significance of mental anomalies is that they, among a number of other factors, accompany the emergence of negative social-psychological traits (which are far from being symptoms of nervous-mental illness). The presence of psychopathic, intellectual and other anomalies, creating a deficiency in the area of the intercourse and activity of the juvenile and disrupting his contacts with the academic and labor collective and with educators, make him particularly susceptible to the negative influences of the microenvironment and further distortion of his social-psychological make-up. This process begins long before a crime is committed; in many observations it begins in early childhood.

The chief feature of the crimes of mentally inferior individuals does not consist in the fact that they are based on peculiar mechanisms uncharacteristic of healthy people. On the contrary, such crimes in the majority are caused by the action of factors typical of mentally normal offenders; at the same time, in part of the observations the influence of mental pathology shows up simultaneously with these factors.

Methods of combating and preventing criminality in mentally inferior individuals. They should include all measures used in connection with mentally healthy people. The most substantial additional method of preventions is the earliest possible detection and active treatment of mental anomalies with the aim of warning of the formation of antisocial personality traits. Anomalous children and juveniles should be the subject of particular concern for upbringers (parents and teachers), since mental deviations easily could become fertile ground for the appearance of crime-generating qualities. In psychiatric institutions a special registration should be organized of patients with mental anomalies not excluding competence and tendency to violate the law (at the present time there is a special registration only for mentally ill, that is, incompetent individuals). In prison facilities it is also necessary to have special registration and treatment of mentally inferior individuals; for this it is necessary to supply the administration of colonies with corresponding documentation (the conclusions of court psychiatric and psychological-psychiatric examinations). All mentally inferior offenders must be subjected to thorough narcological investigation, since drunkenness and alcoholism are widespread among them.

It has become necessary to regulate the evidence for confining mentally inferior individuals, particularly juveniles with a tendency toward crime, to psychiatric hospitals with the aim of reducing their social danger. Such hospitalizations are of use only in those situations when mental anomalies further illegal actions (the presence of antisocial tendencies, it stands to reason, should not be an obstacle to hospitalization if it is medically indicated). The rule



formulated by E.A. Babayan applies in full to juvenile criminal offenders: "It must be stressed that affective reactions and antisocial forms of behavior in people not suffering from mental illness but displaying mental anomalies like a psychopathic personality, neurotic reactions or acutely expressed consequences of organic brain disease (cranial trauma, etc.) may not serve as evidence for urgent hospitalization. In those cases where an individual's socially dangerous behavior arouses suspicion as to the presence of mental disorders in him that are not obvious, such an individual is not subject to urgent hospitalization"<sup>16</sup>.

In the presence of expressed social-psychological deformations in mentally inferior individuals, medical measures acquire significance in the matter of preventing only relatively violent situational crimes (in conditions where psychic deviations further them). Their significance is much less in the prevention of non-situational crimes, since mental disorders usually do not exert a direct influence on them and may even prevent them. A discussion has been carried on over the course of many years in domestic literature over the necessity of recognizing the number of criminal offenders with reduced competence. Without touching on the problem of the advisability of changing current legislation, we will note only that the question of limited competency cannot be lawfully raised for all mentally inferior criminal offenders, but only for those whose mental deviations further illegal activities, that is, with relation to a fairly limited group.

Determining the specific role of mental anomalies is an important point furthering the completeness of the study of the circumstances of crime. The significance of this point is evidently underestimated. It would appear to be necessary to widen the boundaries of the sphere of the psychological-psychiatric legal examination, on consideration of which the question should be raised as to the role of mental inferiority in criminal activities. Such an approach opens new possibilities in the matter of fighting the criminal nature of individuals with mental deviations.

#### FOOTNOTES

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9. The disruption of social adaptation as a consequence of other reasons (for example, the adoption by a subject of a world view that is alien to the given society), it goes without saying, is not classed as a symptom of psycho-pathy. This situation is completely ignored by western researchers in identifying an understanding of "psychopathy" and "sociopathy" (see P.B. Gannushkin, "Izbr. trudy" [Selected Works], Moscow, 1964, 284 p.).
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CYTOGENETIC CHANGES IN CELLS OF LETTUCE SEEDLINGS WITH EXPOSURE TO ACCELERATED CARBON ION BEAM

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[Article by A. I. Vikhrov, Ye. Ye. Kovalev, Ye. N. Maksimova, L. V. Nevzgodina and Yu. V. Potapov, Institute of Medicobiological Problems, USSR Ministry of Health, Moscow]

[Text] Data on the frequency of aberrant cells in lettuce seedlings as a function of the number of hits after exposure to  $^{12}\text{C}$  carbon ions are presented in this study. The number of particles, which passed through the biological objects, and the dose values, received by each seed considering the contribution of secondary radiation in these doses, are given.

Certain disarrangements of cellular structures, as well as deviations in following development in a number of biological objects, caused by action of cosmic radiation, were investigated on artificial Earth satellites and orbiting stations [1-3]. Special attention was focused on the single hits of heavy charged particles (HCP), which according to present day concepts, may induce the most serious radiation damage in biological objects; this is explained by the very high values of linear energy transfer (LET) for these particles. The obtained data on the yield of aberrant cells and cells with multiple aberrations are related to the small mean values of absorbed doses (from fractions of mg-r to several hundred mg-r). The appearance of any perceptible radiobiological effects can hardly be expected in this range of absorbed doses. Attempts have been made to explain the observable effects by radiation action with single hits of the highly ionizing, heavy charged particles. However, such an explanation is not always adequate, because in a number of cases significant radiation damage of biological microobjects has been found when no passing of heavy charged particles has been recorded. Several hypotheses have been expressed to explain the observable phenomena. One of the hypotheses states that, due to the limited experimental potentialities, heavy charged particles with a charge of  $Z \geq 1$  and  $\text{LET} > 200 \text{ Kev/mcm}$  were recorded in

these investigations. However, lighter particles were not recorded with the detectors (plastic) used in the experiments. The second hypothesis is related to the nuclear interactions of neutrons (known as stars) in the bioobject during which low energy charged particles are formed and, consequently, highly ionizing charged particles are formed as well, which in their radiation action are close to heavy charged particles. Such uncertainty may be avoided if a more sensitive radiation detector is used, for example, nuclear emulsion.

Recently, much attention has been focused on experiments in which the effects from single hits of charged particle accelerators are studied. This is the result of the fact that, for the first time, the potentiality to conduct experiments with heavy charged particles (up to iron ions) has appeared and, secondly, the irradiation conditions (smoothness of operation, particle energy, irradiation geometry and others) may be more carefully controlled on the accelerator.

This article is a study of the effects of single hits of accelerated carbon ions in lettuce seeds.

#### MATERIAL AND METHODS

Radiation detectors. A nonbacked "relativistic" sensitive nuclear emulsion of the BR-2 type with a 200-400 mcm thickness was used to identify the passing of carbon ions through the seeds. Layers of emulsion were applied under a nitrocellulose base layer with a thickness of  $\sim 0.5$  mm, on which the bioobjects were attached in one layer with polyvinyl alcohol (PVA). Then, the base layer bonded with the emulsion, was irradiated with a parallel light beam to produce an image ("shade") of the bioobject on the emulsion surface; this allowed us to establish accurately the fact that the carbon ions passed through the biological object and to determine the track coordinates with an accuracy of several microns. A coordinate grid with a spacing of 1 mm was applied to the same emulsion surface to facilitate the search for the images of the bioobjects. To reduce emulsion size distortions during processing in a horizontal plane, the emulsion was bonded to glass, after which the photographic processing was conducted (developing, fixing and others). Scanning of the emulsion and determination of the number of carbon ion hits of the bioobject were conducted on a microscope with a 1000X magnification.

Biological objects. The study was conducted on air dried *Lactuca Sativa* lettuce seeds. The seeds were attached to the base layer and bonded with the emulsion 1-2 days before irradiation. 250-300 seeds were arranged on one base layer. There were several such "sandwiches", layered with lightproof paper, in the assembly for exposure. Following irradiation and obtaining images of the seeds on the emulsion, the base layer with the bioobjects was kept to the time of processing. The numbered seeds were sprouted and fixed

in a mixture of acetone-alcohol (in a proportion of 1:3) forty days after irradiation. Then, a cytogenetic analysis was conducted of the roots in first mitosis on temporary preparations, stained with orcein. Radiobiological effects were evaluated according to the following indicators: frequency of aberrant cells and frequency of cells with multiple aberrations. All the investigated seeds were divided into groups depending on the number of hits, and the effect was averaged for seeds in one group to obtain statistically reliable data.

Conditions for conducting the experiment. Seeds were irradiated with a carbon ion beam with an energy of 3.6 GeV/nucleon on a proton synchrotron of the Laboratory of High Energy of the Joint Institute of Nuclear Research (Dubna). Two sessions were conducted: I - 6 August 1980 and II - 23 December 1981. The geometry of irradiation was the same in both sessions: the assembly consisted of four sets of layers, and the accelerated carbon ion beam fell normally toward the base layer surface with the bioobjects. The intensity of the extracted beam of carbon ions was reduced with the aid of an ion source and by defocusing the beam. This enabled us to obtain seeds with different numbers of carbon ion hits: from single hits (or no hits at all) to several hundred hits. In each experiment, there were control base layers with seeds, which were stored and transported under conditions that were completely identical to the irradiated assemblies, with the only exception being that they were not brought into the experimental hall during time of exposure, which lasted no more than one minute. Following irradiation, the biological objects and the nuclear emulsion were processed according to the methods described earlier.

## RESULTS AND DISCUSSION

In the first experiment, almost all the seeds (with the exception of two) had carbon ion hits, and the frequency of hits varied from one to several hundreds. In the second experiment, the number of hits did not exceed ten and the proportion of seeds with no hits increased accordingly. The study results on yield of aberrant cells in the irradiated and control seeds for both experiments are presented in Table I. The presented data indicate a significant difference in yield of aberrant cells and cells with multiple aberrations from the irradiated seeds compared with the control seeds (approximately double). A very interesting effect was produced in the second experiment in which there was an adequate number of seeds, exposed to irradiation, but in which there were no carbon ion hits recorded. In this case, no differences were noted between the yield of aberrant cells from seeds with carbon ion hits and seeds without such hits.

The number of carbon ion hits in each of the seeds (graph) was considered in studying the frequency of aberrations in the irradiated seeds. The obtained data indicate an absence of dependence of



aberrant cells on the number of carbon ion hits in the investigated range of hits. Fluctuations in the number of cells with chromosomal aberrations as a function of the number of hits (curves 1) are most likely the result of inadequate statistical accuracy of data.

The observable difference in yield of aberrant cells and cells with multiple aberrations for experiments I and II (table 1) is caused by the natural aging processes of the seeds (seeds from the same batch were used in both experiments). The level of spontaneous mutagenesis (percentage of aberrant cells in control seeds) with storage (interval between irradiations) for a period of 1.5 years increased from 0.98 to 1.81, and this is also clearly seen by the yield of cells with multiple aberrations. Based on this, the levels of induced carbon ion mutagenesis, minus spontaneous mutagenesis (according to experiments I and II), proved to be close in value, that is, within the limits of experimental error:  $1.41 \pm 0.13$ ,  $1.07 \pm 0.38$  and  $1.54 \pm 0.40$  respectively. Similar remarks are also valid for the yield of cells with multiple aberrations:  $0.14 \pm 0.03$  in experiment I and  $0.17 \pm 0.10$  and  $0.11 \pm 0.09$  in experiment II.

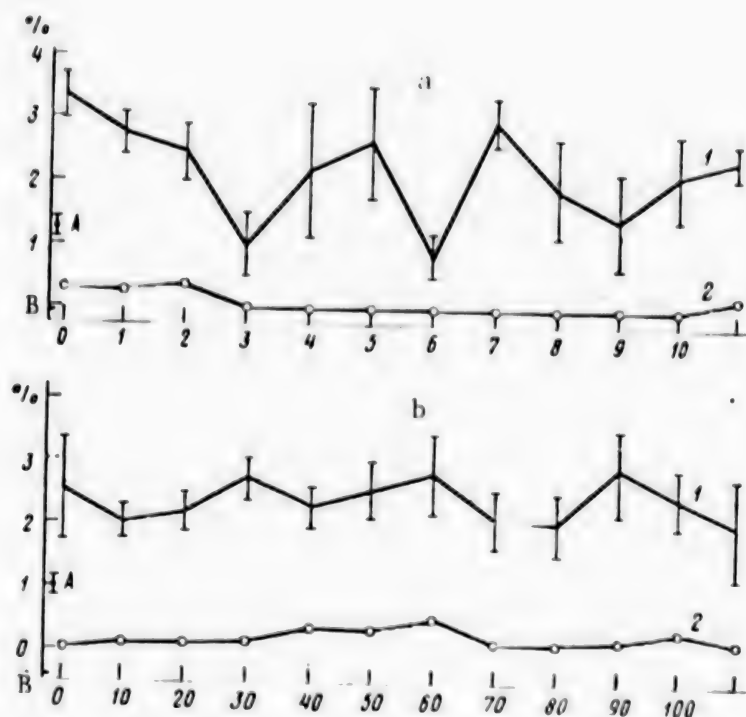
Table 1. Results of Cytogenetic Analysis of Seeds, Irradiated With Carbon Ions With and Energy of GeV/nucleon

	Вариант опыта (1)	Число исследованных корешков (2)	Анафазы и телофазы (3)			Клетки с множественными aberrациями (4)		Число aberrаций на одну aberrантную клетку (5)
			число просмотренных (6)	число aberrантных (7)	aberrантность, % (7a)	число (8)	%	
(9) I Контроль		68	5771	57	$0.98 \pm 0.13$	0	0	1.00
(10) I Семена с попаданиями $^{12}\text{C}$		249	20423	489	$2.39 \pm 0.10$	29	$0.14 \pm 0.03$	1.08
(11) II Контроль		53	2643	48	$1.81 \pm 0.26$	2	$0.08 \pm 0.06$	1.04
(10) II Семена с попаданиями $^{12}\text{C}$		52	3613	104	$2.88 \pm 0.26$	7	$0.19 \pm 0.07$	1.09
(12) II Семена без попадания $^{12}\text{C}$		51	3606	121	$3.35 \pm 0.30$	9	$0.25 \pm 0.08$	1.10

Примечание.  $R_{1-1}=8.6$ ,  $R_{1-2}=2.87$ ,  $R_{1-3}=3.95$ ,  $R_{1-4}=1.1$ . Разница достоверна при  $R \geq 3$ .  
(13) (14)

Key:

- |  |  |
|--|--|
| 1. Experiment variant                          | 8. Number                                  |
| 2. Number of investigated rootlets             | 9. Control for I                           |
| 3. Anaphases and telephases                    | 10. Seeds with $^{12}\text{C}$ hits        |
| 4. Cells with multiple aberrations             | 11. Control for II                         |
| 5. Number of aberrations for one aberrant cell | 12. Seeds without $^{12}\text{C}$ hits     |
| 6. Number of examined cells                    | 13. Remarks                                |
| 7. Number of aberrant cells                    | 14. Difference is reliable with $R \geq 3$ |
| 7a. Aberrant cells, %                          |  |



Dependence of yield of aberrant cells (1) and cells with multiple chromosomal breakages (2) on the number of carbon ion hits (a - from 0 to 10, b - from 0 to 100).

A, B - levels of spontaneous mutagenesis. At each point from 2 to 178 (a) and from 2 to 41 (b) seeds were examined. Along the X-axes - number of hits; along the Y-axes - number of cells with chromosomal aberrations, %.

Additional investigations were conducted to elucidate the reasons for the absence of differences in yield of aberrant cells with a different number of carbon ion hits of seeds, including those without hits; the task of these investigations was to determine the dose value, received by each seed, considering the contribution of secondary radiation to this dose. Seeds were measured that had a large number of hits (in the center of the beam), average number of hits (at beam intensity drop) and seeds without hits (at the edge of the beam). In the same nuclear emulsion, the following were measured: number of "relativistic" particles (basically, pi-mesons and protons) with a relative ionization of  $I/I_0 = 1.0-1.4$ , "black" particles (particles with a range of  $< 3$  mm), "gray" particles (particles with a range of  $> 3$  mm and relative ionization of  $I/I_0 > 1.4$ , where  $I$  - ionization, conducted by a particle in the emulsion and is expressed in the number of silver grains on a 100 mcm track of the particles,  $I_0$  - minimum ionization of a singly charged "relativistic" particle, equal in this emulsion to 20 grains for 100 mcm). Data on the number of particles that have passed through a bioobject, and

evaluations of doses from carbon ions and secondary radiation that are computed on the basis of measurement results are given in Table 2. It is clear that the absorbed dose even for the seeds, located in the center of the beam (with maximum intensity of the carbon ions) during irradiation, does not exceed a fraction of the mg-r. According to existing concepts, such levels of radiation action do not lead to any kind of perceptible chromosomal disarrangements. For example, with irradiation of lettuce seeds with protons (660 Mev) and gamma-quanta, the same yield of aberrant cells, as in this experiment, was observed with irradiation doses of 5 and 10 g-r respectively [4]. The following hypotheses for explaining the observed yield of aberrant cells may be stated: a) influence of the delta-electrons from the electron "fur coat" around the carbon ion track; b) "stars" (nuclear interactions) in a seed under the action of carbon ions and <sup>all</sup>secondary particles, including neutrons, which are not recorded by the emulsion; c) passing of particles that leave "black" tracks.

Table 2. Characteristic Dose Loads Taking Into Consideration the Contribution of Secondary Radiation as a Function of the Number of Carbon Ions, Which Passed Through the Seeds

Top number indicates the number of particles, the bottom number corresponds to the absorbed dose in mcg-r

Ионы углерода (1)	«Релятивистские» частицы (2)	«Серые» частицы (3)	«Черные» частицы (4)	Сумма вторичных частиц (5)	Полное число частиц (6)
346 350	144 4,3	604 60	125 50	873 114	1219 464
8 8	41 1	383 38	18 7	442 46	450 54
0 0	43 1	368 37	19 7,5	430 45,5	430 45,5
0 0	54 1,5	412 41	14 5,0	480 47,5	480 47,5

Key:

1. Carbon ions
2. "Relativistic" particles
3. "Gray" particles
4. "Black" particles
5. Total of secondary particles
6. Complete number of particles

The influence of delta-electrons from the carbon ions, passing alongside the seed, is negligibly small because the size of the "fur coat" from the delta-electrons around the carbon ion track of such energies does not exceed 30-50 mcm, whereas the minimum distance from the root meristem, in which the chromosomal disarrangements are observed, to the edge of the seed is at least 250 mcm. The upper estimate for the probability of a "star" formation in the root meristem zone from all particles, passing through the seeds (it is assumed that the number of neutrons in a beam is the same as in singly charged particles), gives a value of  $\sim 0.01$ .

"Black" tracks are left by low energy short range charged particles, and in their own LET these particles may be not inferior and may even exceed the LET of the primary carbon ions (for example, protons with an energy of 5 Mev have the same LET, equal to  $\sim 75$  Mev/cm, as do the primary falling carbon ions). Since we do not record such short range particles (in the case of their passing or formation in a seed, they most likely will not reach the emulsion because along their way there will be the base layer with a minimum thickness--along the normal--on the order of 0.3 mm), we can only estimate the hits of such particles in the root meristem area. Assuming that the number of "black" tracks entering the emulsion is the same as in the biological objects (the base layer material, from which the particles appear and are recorded in the emulsion in the form of "black" tracks, is very close to tissue in density and atomic composition), the probability of such a short range particle hitting the root meristem zone may be estimated on the basis of measurements. Bearing in mind that the ratio of the root meristem area to the total area of the seed is  $\sim 0.006$ , the probability of a short range particle hitting this zone with  $\sim 20$  "black" tracks for the total seed area is  $\sim 0.1$ .

Thus, the observed absence of differences in yield of aberrant cells with a different number of carbon ion hits (including seeds without hits) may be partially explained by the passing of short range, highly ionizing particles through the root meristem.

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TOPOISOMERASE II--ITS ROLE IN CONFORMATIONAL CHANGES OF SUPERHELICAL NUCLEAR DNA OF LYMPHOCYTES AFTER  $\gamma$ -IRRADIATION

Kiev BIOPOLIMERY I KLETKA in Russian Vol 1, No 4, Jul-Aug 85  
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[Abstract] An attempt was made to determine the degree of participation of topoisomerase enzyme system in postradiation processes involving conformational changes in superhelical DNA of lymphocytes because it had already been shown that such changes do undergo effective repair. Lymphocytes were isolated from peripheral blood of rats and exposed to 8 Gy dose of ionizing radiation; before irradiation, novobiocin, nolidixic acid, novobiocin + nolidixic acid and rifampicin were added to the incubation medium in various doses. Analysis of the data showed that after irradiation, topoisomerase II participated in the appearance of the second relaxation of superhelical domains in nuclear DNA. A mechanism was proposed explaining the participation of this enzyme in the interaction of nucleotides with chemical and physical agents. Based on the data of  $^3\text{H}$ -thymidine incorporation into DNA after  $\gamma$ -irradiation (20 Gy dose) of human lymphocytes, a reparative synthesis of DNA takes place which corresponds to reconstruction of superhelical structure of the nucleotide in these cells. Figures 4; references 12: 2 Russian, 10 Western.  
[2065-7813]



REFORM OF HIGHER MEDICAL EDUCATION IN DEMOCRATIC REPUBLIC OF AFGHANISTAN

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[Abstract] In the prerevolutionary period, two medical schools were graduating about 100 physicians per year in the Democratic Republic of Afghanistan (DRA). The curriculum lasted seven years with 80% of the time devoted to lectures and only 20% to practical work. No licensing examinations were required for practice of medicine. As a result the physicians were not ready for independent work and usually had to study additionally abroad. Thanks to Soviet assistance, specialists were imported starting in 1979; the school was divided into various departments and practical lab and clinical work became the predominant portion of the curriculum (65%). All hospitals and polyclinics became a part of the medical education system. Faculty was expanded, bringing in practicing physicians. Admission to medical institutes increased to 550 students per year with more than 3,000 students studying annually. The new graduates were ready for the practical work outside. A cooperative agreement was signed with Tajik universities so that additional help became available from that source. A research program was developed concentrating on problems relating to DRA conditions. From 1981, scientific conferences began to be organized. Ideological and political education of medical cadres was initiated.  
[2042-7813]

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